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JUNE, 1904. VOL. XXIII. No. 6.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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The
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TURKESTAN AND A CORNER OF TIBET.

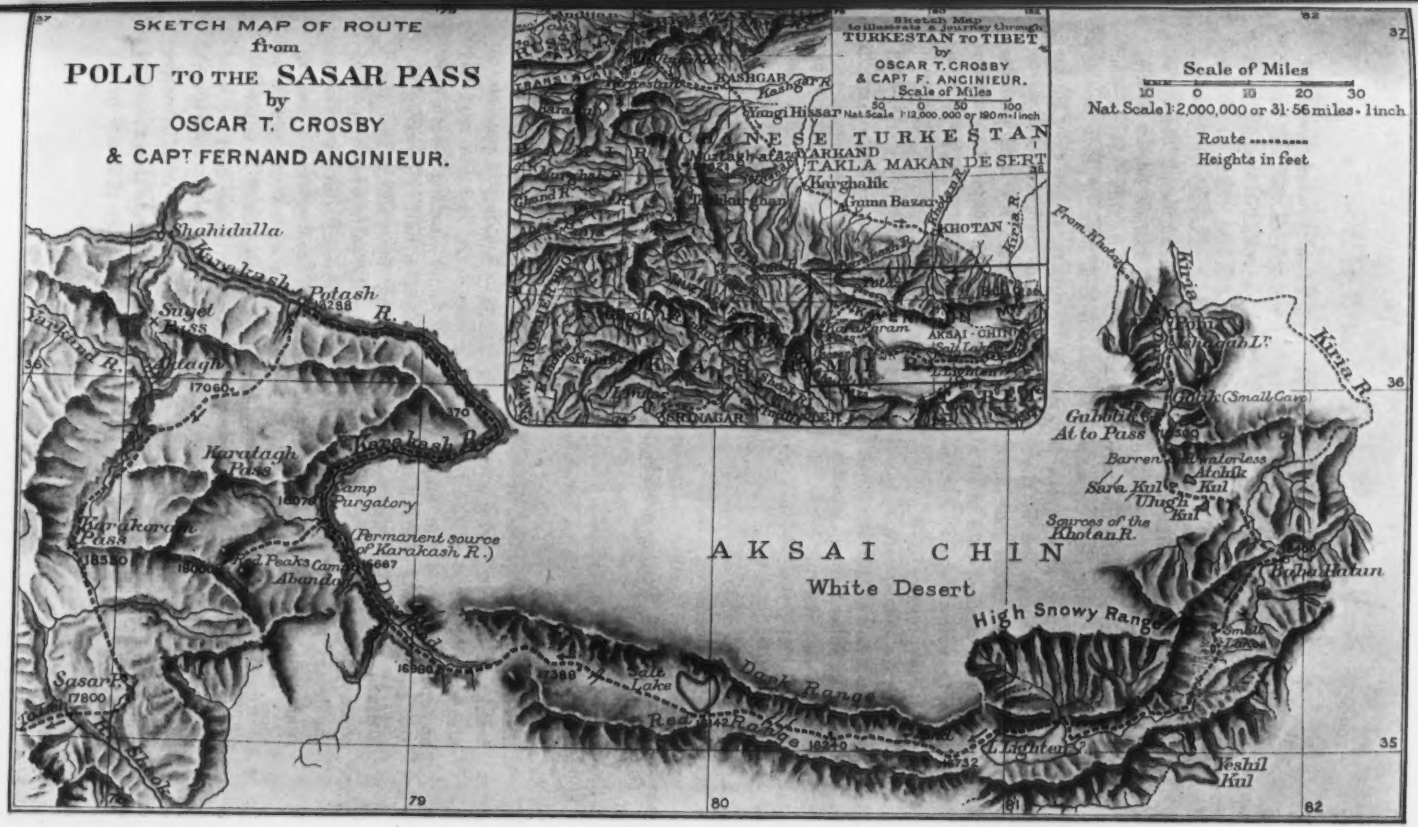
By OSCAR T. CROSBY.

Not hoping to reach Lhasa—whose closed gates can be opened only by disguise or by force—but desiring to see something of Turkestan and of the little-known wastes mapped as Tibet, I left New York last May, passing through London to receive helpful suggestions at the Royal Geographical Society. While *en route* to the Caspian sea, I chanced to stop at Tiflis, and there had the good fortune to meet Captain Fernand Anginieur, of the French army, on leave, who accompanied me to the end. By Bokhara, Samarkand, Kokand, Andijan, and Osh, we reached Kashgar, where we were soon sheltered by the generous hospitality of Colonel Philip Miles, Great Britain's solitary representative in all Chinese Turkestan. I had learned in Africa what a pleasant thing it is to enjoy the comfort and security, physical and moral, of the British officer whom one may meet in the far-away corners of the Earth; yet there was more than the usual reason to appreciate it in this case, as neither Anginieur nor I had any kind of introduction to Colonel Miles. At the last moment a boy of seventeen, Akbar, presented himself at Miles's quarters, and as soon as we heard a few halting English words from his lips, he was at once engaged as interpreter. Happily, we met, through Colonel Miles, a Catholic missionary, Father Hendricks—known to every traveller in Central Asia—speaking an indefinite number of languages, and in all of them uttering always words of charity and helpfulness. He was good enough to go with us as far as Khotan, hence I had nearly three weeks in which to struggle with Akbar before he became our sole reliance.

When M. Petrofsky, Russian Consul-General, knew that we desired to ascend the Tibetan plateau, going as far eastward in Chinese

Turkestan as Polu, he seemed to discourage our venture. Nevertheless our relations with him remained pleasant. The Chinese officials were courteous, and I believe sincerely helpful. We told them that we did not expect to reach Lhasa, but would come out in India, making a roundabout journey *viâ* Khotan and Polu, instead of taking the direct Yarkand-Karakoram-Leh caravan route. Polu is a little village on the lower slope of the Kuen Lun mountains. The caravan route from Khotan to this point offers few difficulties, and provisions can be had almost daily, as one passes small oases every 20 or 30 miles.

The number of our horses on leaving Polu was sixteen. Our permanent servants were only five, with eight others to help the horses up the ridiculous trail by which one reaches the plateau. A large part of our too small grain-supply was also temporarily loaded on donkeys, and entrusted to a body of men who started ahead of us with the avowed object of going as far as about one day's march beyond the pass at the top of the tremendous climb that confronted us. We reached the top without serious damage. When we were at last able to camp near the little lake known as Gubolik, or Serakul, at an elevation of about 15,000 feet, and 10 miles south of the pass that had marked our arrival on the great Tibetan plateau, we felt quite happy. But the donkey-caravan had not come. I need not enter into details of the delay caused by the desertion of our donkey-men and other troubles. It might have been wiser to turn back, make a row, then a fresh start, but the thought of the Kuen Lun gorges urged us forward. We had been led to a spot about 200 yards from a sharp bend in the valley, whose main branch became there practically impossible, while a turn to the right, requiring, indeed, the unloading of the horses, permitted a difficult egress to higher ground. Now it was that I bitterly regretted the lost Nautical Almanac and chronometer. Longitudes were impossible. Latitudes could be observed at meridian passage of the sun, but no results could be had without figures for solar declination. Several such altitudes I took by sextant, and the results appear in the sketch-map shown. A rather small and badly built compass had furnished me with azimuths taken at short intervals (average of thirty minutes' march) since leaving Khotan, and estimation of caravan rate gave horizontal distances. Such compass work is very useful, and good enough when checked by astronomical observation; but it is not close enough, in an absolutely trackless country having a complicated mountain system, to keep one on any selected line taken from a small-scale and necessarily inaccurate map. We could only try to keep in the right general direction—west and south—yielding readily to the welcome constraint of favouring valleys, meantime looking out for some indication of a road southward to Rudok. Thus we marched to the end of the valley in which the guide left us, and which must be that of the sources of the Keria, and into which we had come over a pass 18,000 feet high. Between two good openings


SKETCH MAP OF ROUTE
from
POLU TO THE SASAR PASS
by
OSCAR T. CROSBY
& CAPT FERNAND ANCINIEUR.
Sketch Map
to illustrate a journey through
TURKESTAN TO TIBET
by
OSCAR T. CROSBY
& CAPT F. ANCINIEUR.
Scale of Miles
50 0 50 100
Nat. Scale 1:12,000,000 or 190 m. = 1 inch
Scale of Miles
10 0 10 20 30
Nat. Scale 1:2,000,000 or 31·56 miles = 1 inch
Route
Heights in feet
CHINESE TURKESTAN
YARKAND
TAKLA MAKAN DE SERT
KHOTAN
AKSAI-CHIN
White Desert
AKSAI CHIN
High Snowy Range
Dark Range
Red Range
Salt Lakes
Shahidulla
Karakash R.
Polash R.
Suget Pass
Yarkand R.
Karatagh Pass
Karakash R.
Camp Purgatory
(Permanent source of Karakash R.)
Karakorum Pass
Peak Camp
Abandon
Sasar Pass
Kiria R.
Gulbuddin's Pass
Barren Wanderless
Sara Kul
Uhuch Kul
Sources of the Khotan R.
Bada Hatun
Small Lakes
Leshil Kul
Kiria R.
79
80
81
82
35
36
37

at its lower end, we chose that which trended southward, and after some twisting came into another valley, 10 miles wide, flat and sandy, which, with its lateral mountain chains running east and west, constitutes the dominating topographical feature of the Aksai Chin, or White Desert, whose unknown sands we were now about to cross.

About ten days after we had reached the plateau, being always at elevations between 15,500 and 18,000 feet, the horses began to die. That is the misfortune that overshadows all travel in this fatal region. And without transport animals, man cannot live here. There are no inhabitants in an area several hundred miles square, as has been shown by our experience and by that of other travellers going east and south of our route; hence food must be carried sufficient for long periods. Protection against cold must also be carried, in the shape of sheepskin coats, heavy wraps, etc. These with food-supply cannot be packed on one's back, especially when physical effort is made difficult by reason of the rare atmosphere. It is this condition, together with the extreme nocturnal temperatures, which kills the horses, even before they have begun to suffer from starvation.

The question of water, though always vexatious—particularly by reason of the treacherous mirage—was not a tragic one. We had several dry camps, once moistened only by a single bottle of water, at other times by as much as could be coaxed to stay on a pack-saddle in a rubber pneumatic bed.

When we reached the western end of the valley we plunged into the mountains, putting aside for the present all thought of Rudok, and let Lassoo (who had been with Wellby) conduct the caravan. That we crossed a pass was certain, but we could not find Lanak. The valley into which we had fallen carried us north-west, instead of south-west as we desired. The grain-supply was now so small, and the condition of the horses so bad, that it seemed best to abandon trunks of clothes, books, instruments, etc., thus making it possible to also abandon some of the horses. This was done, and the next day an opening-out of the main valley was found leading south-west. We ascended this sub-valley for two days and a half, increasing our altitude by nearly 2500 feet, cheered at first by finding two small stone monuments and a visible trail, but finally quite discouraged by the dreary prospect of tumbled, snow-clad mountains which we viewed from an altitude of 18,300 feet, through a threatening veil of falling snow. There was indeed a valley in front of us with three breaks in its walls that might give issue, but which of these should be entered—how far they could be followed—we knew not. Lassoo said we must surely die if we continued. We knew that in his long journey with Wellby he had suffered much and bravely; it was not an idle, native whine. We had two bushels of grain. The ten horses that remained alive were scarcely able to travel. Anginieur, though pluckily in the

saddle, was still badly affected by the altitude. Nothing remained but to retreat, and, when a good camp could be found in the main valley, to give to Mohammed Joo and Lassoo the best horses and the remaining bushel of grain (we used one in descending to the main valley), and send them forth as Noah sent the doves; the other five of us to remain in camp until their return, or until such delay had occurred as would argue their return improbable. Our men had set out cheerfully, believing that at any moment they might find a shepherd, and that in any case five or six days would suffice to bring them back with succour. We adopted this theory, though rather for the sake of having a theory than because of any known basis for it. That we were within 50 or 100 miles of some permanent village on the south-west seemed quite

TYING THE LOADS AFTER A HARD CLIMB

certain, but even 50 miles, when one is in a snarl of mountains such as the Karakoram Himalayas, might easily mean the end of all things earthly for men equipped, or non-equipped, as we were.

As to what would be found within accessible distance to the north, we did not know. Our envoys proposed to follow the valley, now carrying a considerable stream, assuring water-supply, and probably offering an easy road for the horses. Nothing else seemed as promising. As to the good faith of these men, of course the question would continue to arise in our minds. Their past record was excellent, and it was a chance we must take with all the others constituting our hard conditions. When they left camp Purgatory, taking the very last ounce of grain, we had played our last card. Mir Mullah, our pious old

Afghan, prayed with more than usual zeal, but confided to Achbar that he expected to die here. If it were Allah's will, then no better place could be found. So the time passed wearily enough, until on the eleventh day. Then, while shooting at the uneducated fish which would not bite, lo! an answering report was heard. Half an hour later our trusty men appeared, behind them three Kirghiz bringing four camels and riding two ponies. The strain was ended; we were safe, and still had four days' rations.

The relief had come from a point nearly 150 miles distant, though three Kirghiz tents had first been found at about 100 miles from our camp. Unfortunately, the Kirghiz refused to go southward. One could not blame them; they knew nothing of the country. Northward back to their camp, the way was known, which, as we now learned in astonishment, would lie, for six days' march, along the valley of the Karakash as far as Potash, which is not a village, but a known camp-ground. Thence they would take us to the Yarkand route, and as far as camels could travel on that road—that is to say, as far as the great Sisera mountain, whose glaciers and snows have been trod for centuries, but only by horses and yaks. It was hard to give up Rudok, but the Kirghiz were not to be moved in their determination, which, indeed, was a necessary one. So we waited one more day to give grain to our surviving horses, a little rest to Mohammed Joo and Lassoo, and to recover our abandoned luggage now that there were four strong camels for the burdens. Then we set out, free from care, but, so far as I was concerned, sadly disappointed.

For four days of march in succession we had good fires, beside the day spent with the hospitable Kirghiz, who put one of their cosy tents at our disposal. It would be very pleasant if one could be assured that even a half of the Christians one must meet were as honest and kind as these simple Mussulman folk. From their camp to Potash; from Potash, leaving the Karakash valley at last, to a junction with the Yarkand-Leh route, and we were again in *terra cognita*. We had still to slip and slide and freeze over the passes and glaciers and in the deep valleys of this world-old route, but now we met caravans daily; we were in touch with the world. Finally we came to trees again in the wonderful Nobra valley, where Lamaism, protected by Sisera's snows on the north, and by Kardung's glassy heights on the south, still turns its prayer-wheels, flutters its painted appeals in the passing breeze, builds its white shrines more numerous than the men themselves, piles its myriad carved stones on roadside monuments, sounds its solemn drums, teaches its charitable precepts—all unmindful of the streams of Hinduism and of Mohammedanism flowing backward, forward, along the road which time and Asia's genius, Patience, have worn through the peaceful valley, over the forbidding mountains—to Yarkand and far Kitai on the north, to Leh, Srinigar, and the Indian world on the south.

Memory lingers lovingly over the beauty, the quaintness of this valley, and of all the great panoramas, the monuments, the men of Ladak, and of further Kashmir; it lingers thus until startled back to our life of iron and unrest by the locomotive's shriek as it approaches Rawal Pindi.

Let us, however, before shutting ourselves in a compartment, recall for a moment the aspect of the unexplored region that was traversed, and see what changes may be suggested in the map of this lost corner of the world. While ascending the mountains from Polu, one sees rapidly at work the forces of disintegration attacking the vast masses

A KIRGHIZ FAMILY.

of exposed friable material. Slates, shales, conglomerates, loose sandstones—such are the abounding substances which the torrents wear away. One also sees some large pebbles of the harder materials scarcely to be found now represented by the strata above them *in situ*. Great as are these changes now, they must be pigmy efforts compared to the titanic movements of the past. On the plateau one sees and travels in veritable rivers of sand, whose large limits mark the boundaries of some great slow stream whose waters came down from vanished heights. Again, where the slope is greater, the course of a mighty torrent is marked by close-packed, rounded boulders. In one such case, we followed the bank of such a silent river of stones to an

elevation of 18,000 feet, where a flat area about 3 miles long showed boulders laid so accurately to the level, so cemented by sand, sometimes so regularly formed in circles, that one would have thought it a pavement of giants leading to the foundations of huge temples. Save, perhaps, in some stretches of the upper Blue Nile, I have never seen a stream having at the same time the width, volume, and velocity suggested by these boulders, now for ever dry. Many of them seemed to be granitic, though granite strata were not seen in the neighbouring heights, which here—as generally across the Aksai Chin—rose to an elevation of from 1000 to 3000 feet above the flat areas. The existence of such tremendous hydraulic force acting on materials no longer seen in the position of upheaval, hints of the degradation of complete strata of the towering masses that have been crumbled perhaps from a uniform elevation not less than that of Mount Everest. When one considers the wide-stretching sands of all Central Asia and the empire valleys of India as being probable deposits from these heights, the supposition just made seems not over-bold.

Snow appears on the Kuen Lun range at an altitude of about 14,500 feet, and at about 16,500 on the mountains rising from the plateau, the level spaces of which, in September and October, are substantially clear. The light snowfalls, such as experienced, were quickly evaporated during the warmer hours of the day by the fierce winds blowing quite regularly from the south-west, and constituting one of the serious hardships of travel.

Volcanic action has not been of wide extent. Indeed, one sees so little of it along the whole line traversed by us over the Alai, Kuen Lun, Karakoram, and Himalaya ranges, that I was the more forcibly struck by the two areas in which this action is unmistakable. One is near Lake Sarakul, and is about 5 miles square. Within that area one may see several true craters and numberless black, tortured masses rising about 75 feet above the surrounding coarse sand. On the edge of this area was another smaller one showing petrification of all the stems and roots of a hardy grass. There was nothing to indicate the continuation of any process of infiltration to account for the petrification, though possibly the area, which lay 4 miles from a sulphurous lake, may at times be flooded.

The second volcanic region was noted near the point marked camp Desertion. Here the surface of the narrow valley was covered, for a distance of several miles, with characteristic volcanic boulders, and outcroppings of lava in mass showed in the sides of the confining heights. In the great east-and-west valley, however, nothing is seen save what may be attributed to the ordinary effects of erosion. That which is particularly noted here, however, is the marked difference in material and appearance between the two chains limiting the valley. That on the north is a sort of double chain, presenting toward the

valley a front of foothills, black or dark greyish in colour, and showing the rounded forms that have been subjected to erosive action for a period relatively long. Behind them, and sometimes concealed by them if the intervening distance were considerable, rose the main chain, always snow-capped, and also showing rounded characteristic smooth forms. This chain sometimes receded from the line parallel to our route, but seemed never to lose its continuity until merged in the Karakoram range.

On the south side the colour was bright brick-red, the forms sharp, turret-like, fantastic, suggesting relatively short and violent hydraulic action. So great was the difference that I was led to suppose the

CAMP PURGATORY AND ONE OF OUR DELIVERERS.

southern chain may have resulted from some later earth-movement than that which gave birth to the northern range. These two characteristic forms and colours are found mingled in inextricable confusion at both ends of the valley; and, again, the chapels, towers, minarets of red appeared along the short valley which we ascended near camp Purgatory. This appearance has probably given rise to the misplaced name Kizal Jilga, shown further south on existing maps. The Kirghiz had never heard of this name as belonging to this locality, nor, indeed, of any of the names shown on the R.G.S. or the latest Russian map, as along and near the Karakash. They applied the name Kizil Jilga to a big red mountain on the Karakoram route. As in all this region there are no other inhabitants than the Kirghiz met by us, it would perhaps be well to omit these *noms de fantaisie* from future maps.

The two lakes shown on our route deserve, on the other hand, that some name be given them. One, of fresh water, is possibly that called Lake Lighten by Wellby, though it is probable that his route lay a little to the south near the smaller body which is marked with broken lines, and which I saw only from a distance when I had climbed to the top of a mountain, whence the tired eye wandered over a maze of flat, narrow valleys and errant ridges, snow-capped or bare. One affluent, but not a single outlet of this beautiful sheet was seen, though we carefully scanned its borders. This, apparently, is the lake seen at a distance by Captain Deasy, and suggested by Dr. Stein as the probable source of the Khotan river. If this be true, its waters doubtless reappear after flowing through underground channels—a thing not infrequent in these regions. The other lake is salt, and has been visited by natives, we thought, because a trail was seen near it, which we tried to follow, but vainly; it gradually disappeared in the sands. Perhaps it had been made only by wild yak and wild horses. A remarkable lowering in the level of the lake seems to have taken place in recent years. Well-defined banks stand up about 15 feet from the general level of the sand now separating them from the water's edge—sometimes by a distance of two miles or more. These banks are still sharply defined, suggesting that only a few years have passed since they were filled. No such affluents were seen as are shown on the latest Russian map in connection with a lake occupying nearly the position given by my notes to this sheet of salt water. Information concerning the lake, and concerning the mountain system of Aksai Chin, has doubtless heretofore been taken only from the reports of natives. The error in respect to the mountains is considerable. The dominating chain is not north and south, as heretofore shown, but there are two east and west chains, generally parallel to the Kuen Lun. The first lake and the salt lake both lie closely ensconced in bounding hills of the valley, which narrows at these points. Heretofore they are shown as in open plains.

Another correction of some importance has to do with the course of the Karakash, which has been shown heretofore as extending 60 miles or more further south than is the fact. We chanced to come into the valley of this stream above its permanent sources, which come up out of the sand. There was seen, indeed, a small break in the valley wall, corresponding to the point where the assumed southern extension (shown dotted) appears on older maps. But this opening was seen to have a steep incline upward, and no water came from it. Nor can a considerable volume come at any time, as just below this point the valley was crossed completely, from hill to hill, by a very curious line of small stone monuments, about 2 feet apart, and consisting of small boulders piled about a foot high. The line must have been more than a mile in length. I surmised that when the Kirghiz found grass above, as might sometimes be the case, their sheep were driven to a

central opening in this line, and perhaps there divided, or caught for shearing. As there was no human being within many miles, we shall never know.

The plateau which we reached when making our last effort as a united caravan, is a spot of unique interest. The ridge which stretched its forlorn length right and left separates the Hindustani plains from the Gobi desert. The snowflakes that fell around us might be divided as they melted—part going to the hungry sands of the north or the still depths of Lob Nor, part to be warmed in the glistening bosom of the Indian ocean. Throughout the vast length of the Karakoram and Himalaya ranges Nature seems to have

HELPING HORSES ROUND A BAD CORNER.

raised these tremendous masses that here, wrapped in spotless white, she might sleep undisturbed by her inquisitive progeny, her *enfant terrible*, restless Man. But in vain. Children of the desert, children of the delta—led by love of gain, led by lust of war—for thousands of years they have climbed and crawled over the frowning mountains. The pace of commerce is slower now than in the past, I think, for the building of the Trans-Caspian railway to Andijan—sixteen days by ordinary caravan from Kashgar—has greatly affected the relations between Turkestan and the rest of the world. The wonder is that even the present volume of trade with India can be maintained. Let us glance at the routes southward from Kashgar. First, to the west, is the Gilgit route, by which the British representative receives mails from Srinigar. It is short, but not sweet. Caravans attempting that road

are unloaded, the goods being carried over considerable distances by coolies. This is sufficient to class this route as now impracticable for large movements. The Indian Government is now, I believe, doing some work of improvement, but only as far as its own purposes require in the Pamirs, not for curing the defects as far as Kashgar. An alternative route, branching from the former at Karatchunkar, goes by Skando and Kargil to Srinigar. It is no better than that by Gilgit.

Next is the Karakoram route, the worst part of which we traversed. To any European, it must be marvellous that human beings consent to regularly traverse this road. Much has been done of late by the Indian Government — perhaps I should say the Kashmir Government — to diminish the toils of the caravans which here carry substantially all of the traffic between India and Central Asia. The distance from Rawal Pindi to Yarkand—measured in time of ordinary caravans—is about forty-five days, as against less than half that time between Andijan and Kashgar, which in turn is about seven days from Yarkand, the two cities being in themselves of approximately equal importance, though Yarkand is the better distributing point. The Karakoram route is, moreover, more expensive than its northern rival, the mortality of horses at Kardong, Sisera, and Karakoram pass being frightful. The number of skeletons seen is almost past belief. The single fact that between Kardong and Sisera it is always necessary to do away with camel transport, and that on Kardong itself horses must often be replaced by yaks, puts this route out of consideration for the movement of large bodies.

The important question remains—is it possible to reach Leh without passing the glaciers and snow-drifts of Sisera and Kardeng? and if so, is the alternative route better than the one now used? The answer is a probable affirmative. A discussion of the reasons for such answer would be too full of topographical detail to be here undertaken. I shall only anticipate one natural query, "If this be true, why has it never been done?" Because there are yaks enough to meet the present small demand, thus making it possible to use the present, which is the shorter, though harder route. If there were not sufficient yaks, I think a more easterly route would be used. There was more actual difficulty of movements in the five worst days of the Karakoram route than in the whole march across the Aksai Chin and along the Karakash valley, and more than other travellers have met in reaching Lanak pass from Ladok Leh.

It remains to be considered whether the Polu route from the desert to the plateau may have any future importance. It has now been traversed by four different parties of white men. Our visit, the last of the four, found it a little better than in the past, due to the improvement mentioned above. It would be possible, by a small application

of intelligent engineering, to make this a fairly easy ascent. The water-crossings would require short bridges to render them accessible to passage of men on foot. Assuming that the ascent has been accomplished, one asks whether the great plateau, cris-crossed by mountain ranges, may be successfully traversed to reach Leh, lying south-west, or Lhasa, lying south-east—the one distant by best route about 400 miles, the other about 600 miles.

For small parties, specially equipped, giving their few horses advantage of the scant grazing, it has been shown by experience that, though with delay, with hardship, the Tibetan plateau may yet be transformed from end to end But for large bodies the thing seems to me practically impossible. The yak is the only animal which could make the journey without suffering losses probably fatal to the venture. But of these the number is wholly insufficient. Moreover, when the small caravan finds just water enough, the numerous body must go thirsty.

The Kuen Lun range has been scaled yet further eastward—about 150 miles from Polu—by Captain Deasy, but the conditions found on the plateau are substantially the same as those here discussed, save that the distance from Leh is somewhat greater, from Lhasa somewhat less. The conclusions as to movements of large bodies would, I think, be the same for this last route as for the Polu way. Two other suggestions, and I have done: (1) In no one of the cases considered can

MR. CROSBY AT AN ELEVATION OF 18,000 FEET.

wheeled vehicles be thought of; (2) all the routes are subject at divers points to sudden interruption or deterioration caused by land-slides or

changing course of mountain torrents; (3) the roads here mentioned—impracticable as they seem to me—are yet less impossible than any

TYPICAL VIEW OF THE KARAKORAM HIMALAYAS.

approach from the north along lines further east, until one reaches China proper, since the width of desert increases in that direction.

The inhabited portion of Tibet must have its relations along lines north-east of Lhasa, or else southward, unless that greatest of all conquerors, the railway, should miraculously come down over the sands from the Austral forests.

The chief value of the short journey, whose incidents you have heard this evening, lies in this: that it tends to complete the demonstration of this fact—namely, that in itself the Tibetan plateau is valueless to European civilization; and that this plateau, with its great escarpment, the Kuen Lun range, may well be taken as bulwark and barrier between two great empires.

Before the reading of the paper, the PRESIDENT said: This evening we are favoured with the presence of Mr. Crosby, who, many of us will remember, communicated a most interesting paper of his travels in Abyssinia three years ago. Now he has been in a country which at the moment is still more interesting to us—Central Asia. I will now call on Mr. Crosby to read his paper.

After the reading of the paper—

Sir THOMAS HOLDICH: Mr. Crosby has given us a very vivid description of the desolate nature of one of the remote corners of Tibet up in the extreme north-west, and he has expressed an opinion, which I think we most of us share, that it

is absolutely impossible for any large party, any force of any size, to journey from north to south across the wild and bleak and desolate region of the northern half of Tibet down into the southern, which is of a very different character—the valley of the upper Brahmaputra. But perhaps it will be interesting to you to know that this question as to the feasibility of crossing the Alai mountains was discussed four hundred years ago just as keenly as it is discussed now. Just about the same time that the Emperor Baber was establishing the Mongol dynasty in India, a general of his, who was much connected with Central Asian affairs, discussed the question as to whether it was possible to reach Cashmere by the same route which Mr. Crosby attempted, and found impracticable. He came to the conclusion that it was not possible, so he resorted to the route which Mr. Crosby finally took, and crossed the Karakoram; and he crossed with, not half a dozen followers, but with a large force. They came down into Rudok, and conquered that country, making it a base for a fresh start into Lhasa. This is interesting to us from the point of view as to whether it is possible for an armed force to reach Lhasa from the west. The Monguls made a good try, and then the inevitable thing happened—their horses died, but with only ninety men they succeeded in getting as near as Shigatse, which they reckoned was eight days' march from Lhasa. Then they turned round and went back to Rudok. Another interesting point is that the Tibetans, after true Tibetan fashion, received the Mongul general with great hospitality; they even assisted him to get together another force to harry another part of their own country. Well, it was centuries after that the next attempt was made from Rudok to reach Lhasa. This time it was made by Sikhs. General Zorawar Sing, acting for Ghulab Sing, who was the Raja of Kashmir, attempted to reach Lhasa by Leh. He came to grief exactly as Mirza Haidar had come to grief before him—his horses gave out before he got to Lhasa, and he beat a somewhat hasty retreat. It is curious to observe that the fighting that was done was not done by Tibetans, but by Ghurkas, who were sent across the border to fight them. Thus we learn from history that the attempt to make any military movement, at any rate from the west, is an exceedingly difficult and perilous one. Once again, not long after, a small and turbulent tribe of the Himalayas, the Ghurkas (who had conquered Nepaul), thought it was time to have a look into Tibet itself. They made their attack directly over the passes, and they were successful; moving very rapidly, they succeeded in reaching Tashilumpo. They absolutely destroyed the place, and they were inclined to settle down there. When the authorities fled to Lhasa they sent information to China, and asked for assistance; and then followed what I really believe to be one of the most remarkable military movements that ever was made in the world—70,000 Chinese are said to have crossed the passes from the east to get to Lhasa. From the borders of their own country to Lhasa is a good 1200 miles, and although a part of the country is very different from that which Mr. Crosby has described, *i.e.* the upper valley of the Brahmaputra and the immediate neighbourhood of Lhasa, which is comparatively low, and where there is a considerable amount of cultivation, still, the greater part of the journey must have been across most horribly difficult mountain passes, where they must have lost multitudes of men. Nevertheless, they not only reached Lhasa, but, having got there, they started for another 400 miles *en route* to Nepaul. They beat the Ghurkas handsomely, first of all to the north of their own mountains, and then followed them over their passes. The Ghurkas made their last stand some 20 miles in front of Khatmandu, and there the Chinese finally defeated them, and left such a reputation behind them that to this day the Nepaulese send deputations to China once every five years to pay tribute. It only shows us the danger of depreciating a possible adversary.

The best fighting men that we know in the East are Ghurkas and Sikhs, and yet they have been beaten all to nothing by Chinese in times gone past. And to this day Chinese authority over the whole of Tibet is practically as sound, I imagine, as ever it was. I would ask you, in conclusion, to differentiate carefully between Northern Tibet—the Tibet which Mr. Crosby has described to-night—and the true "Bodyul," which is the scene of Colonel Younghusband's mission at the present moment. It is only in South-Eastern Tibet, in the upper valley of the Brahmaputra, that there really is a country which you may say, climatically, is tolerably suitable for European life; and it is a point to remember that Lhasa, the capital of Tibet, is situated—if not on the banks of the Brahmaputra river itself—on the banks of a small tributary of the Brahmaputra; and that it is not only the capital of Tibet, but the religious centre of such a vast number of people that I believe, taking them altogether, they number almost one-third of the population of the world. Now, I have been told that during the war in China, about one-third of China did not know that any war was going on at all; they did not take any interest in it. But I will venture to say that if two European officers were to reach Lhasa, within a few months it would be known over the whole of China whether these officers were British or Russians.

Mr. MACARTNEY: I have listened with very great interest to Mr. Crosby's paper, not only on account of its intrinsic interest, but also from the fact that he has been describing a country over which I myself have had some experience. The route which he took from the Caspian sea to Kashgar is known to me, and I have also travelled from Kashgar along the route through Yarkand. I should like to ask Mr. Crosby whether, when he was at Khotan, he had any occasion to gather any of those antique remains which are largely to be found in that region. As is well known to you, and I think especially to those who have had occasion to read the book published by Dr. M. A. Stein, you may now travel for several marches from Khotan into the desert, and you would come across here and there stretches of ground strewn with ancient pottery, and ancient sites, now half buried in the sand, showing the remains of old houses. In all that region many manuscripts have been discovered dating back to the seventh century, and others still older, Indian manuscripts dating back to the third century, and also remains of still older date, even of a period before the Christian era—remains showing evidences of a Greek civilization. It seems to me that Eastern Turkestan is a good field for archæological research. Dr. Sven Hedin gave us a very interesting account not very long ago in this hall of the identification which he was able to make through archæological research of a place known as Laulan, on the borders of Lob Nor lake. Now, Laulan is very well known by the Chinese, and during my stay in Kashgar I bought accounts from the Chinese of this place; but it is strange that, although the ancient annals are full of this, not a single Chinese litterateur was able to tell me where that place actually was, and it is owing to Dr. Sven Hedin that this place has been identified. It seems to me this is a service which archæology has rendered to history, and possibly, also, in the course of time we shall find that through archæology, and also with the assistance of Chinese ancient history, we shall be able to identify the place where the ancient Lob Nor lake existed. There is another point which has also been mentioned. Mr. Crosby told us a good deal about the difficulties which those mountain barriers offered to the movement of a large body of troops. Among the finds Dr. Stein was able to make, there was, I believe, a document which showed that in former times there was a Chinese army which crossed from the plains of Eastern Turkestan to Gilgit. I think this is a matter of some interest, showing that after all, although mountains are difficult in the extreme, yet they are not impassable to a large body of troops.

The PRESIDENT: Lord Osborne Beauclerk has just returned to this country from this Central Asian region; perhaps he may be able to throw some light on the geography of the place.

Lord OSBORNE BEAUCLERK: I am afraid that I cannot give you any useful information, having been out on a shooting trip only, whence I only returned a fortnight ago. Twelve days' posting by tarantass took us to Kulja, over the Chinese frontier, where we fitted out our caravan, and thence a nine days' march to our ground on the Koksu river, a tributary of the right bank of the river Tekkes, in the east Tian Shan mountains. On our way we were welcomed with the greatest hospitality by the inhabitants—Kirghiz, Kazaks, and Kalmaks, whose photographs Mr. Crosby has just shown you. They appear to live on mutton, horseflesh, and mare's milk, and keep their oxen for pack-animals and for riding. Some of them had seen Mr. Littledale, who was here two or three years ago, and he had evidently created a good impression, as they overwhelmed us with presents of sheep, which became very embarrassing after a time. There were only myself and a friend, with six camp-followers, and we received twelve sheep in five days, and as the inhabitants have no use for money, and we could ill afford to give them our groceries in return, we used to give them empty sardine-tins, with which they were delighted, and which the ladies used to hang round their necks. We met Dr. G. Merzbacher at Tashkend, on his way home.

Mr. OSCAR T. CROSBY: In answer to Mr. Macartney's inquiry concerning what was found in the way of antiquities at Khotan, I have brought back with me, as any one may see in the room where the photographs are shown, a mass of portions of manuscript. I do not know whether any one is able to read them. I was wholly unable to read anything myself, but I was told by Father Hendricks that they were authentic. I have shown them to some of the savants in Paris, who said I had better show them to Dr. Hœrnle at Oxford. It is possible, as there are three different kinds of writing in that mass, that he will be able to decipher some of them. They were brought to me by the Aksakol who represents the Hindu merchants of these states. His character I presume to be above reproach, because he had been appointed by Mr. Macartney. As to the passage over the Karakoram, Father Hendricks suggested that possibly, say only six or seven hundred years ago, the Gilgit pass might have been in a much better condition than it is now, and in order to explain the passage of the troops—the one Mr. Macartney referred to—he thinks one of the allies of Alexander went down, passing by Gilgit. His idea is that that is the route, and that the wear of the water in five or six hundred years has considerably deepened various points, and that thus the width has been considerably narrowed. I cannot vouch for that at all, but I do believe that nowhere in the world have the changes been more rapid than in the paths that are stopped by the mountain torrents of the Himalayas. The rapidity with which one can see these things going on under one's eyes is astounding, and I was constantly impressed with the thought that a thousand years, which after all is not a very great space of time, stretching back into Chinese history, might give rise to difficult situations in this or that route. I saw, in passing over the Karakoram, places where you could see traces of paths that are now 600 or 800 feet above the route followed to-day. And one is lost in considering how old that upper path may be! Why was it used then when no one could pass over it to-day? Now and again you pass a stream which is undercutting the whole mountain-side, and you can calculate that it will not be long before it will tumble over. Then there will be a great lake formed, and it will sweep away the dam. There are some remarkable cases where a big stream apparently, that is, judging from the width of the bed, is absolutely closed by the falling of the mountain.

Hence, we cannot legitimately conclude, because the Andijan country or China was able six hundred or a thousand years ago to put an army through, that such an army can pass now. We must go by the passes we find. And again, we must consider possibly that such an army was more mobile far than any army which is likely to attempt the passes now.

The PRESIDENT: We have listened to a most interesting paper, and to an equally interesting discussion. The great plateau of Tibet to which Mr. Crosby has alluded, and portions of which he has visited, is, geographically speaking, I consider, one of the most interesting portions of the globe. He has suggested various causes for the existence of that vast plateau, and he has described to us the changes that have been taking place in it. I do not believe that any army, for the invasion either of Tibet or India, has ever crossed it. The invasions Sir Thomas Holdich has alluded to have all gone along the valley of the Tsanpu or from the eastward; none have ever passed over the lofty desert. Therefore I think in that respect it does form a great barrier. Mr. Crosby's paper has been exceedingly suggestive in many ways, and I am sure the meeting will wish to pass a very cordial vote of thanks to him for the agreeable evening we have spent.

THE DESICCATION OF EUR-ASIA.*

By Prince KROPOTKIN.

1. RECENT exploration in Central Asia has yielded a considerable body of evidence, all tending to prove that the whole of that wide region is now, and has been since the beginning of historic record, in a state of rapid desiccation. At the present time, evaporation over the whole of Central Asia is very much in excess of the precipitation, and the consequence is, that from year to year the limits of the deserts are extended, and it is only in the close neighbourhood of mountains, which condense vapours on their summits, that life and agriculture are possible with the aid of irrigation.

Traces of a desiccation which has been going on with great rapidity during historical times abound everywhere in Central Asia. Not only on the borders of the mountains which surround East Turkestan, but even in the interior of the now terrible sandy desert of Takla-makan, explorers, among whom Sven Hedin deserves special mention, have discovered ruins of wealthy cities, monasteries, and irrigated fields, amidst arid deserts where life is now impossible. Further east, all evidence concerning the basin of Lob-nor tends to prove that at times not very remote from our own the whole of the triangular depression between the Tarim in the west, the dry bed of the Concha daria in the north, and the southern shore of Lake Kara-koshun-kul in the south, and now occupied by a terrible desert, was occupied by a great lake, the Lob-nor, which at a later epoch, mentioned by the Chinese historians, was broken up into a number of smaller lakes, of which the Kara-koshun-kul is now the last survivor.

The region at the southern foot of the eastern Tian-shan, including

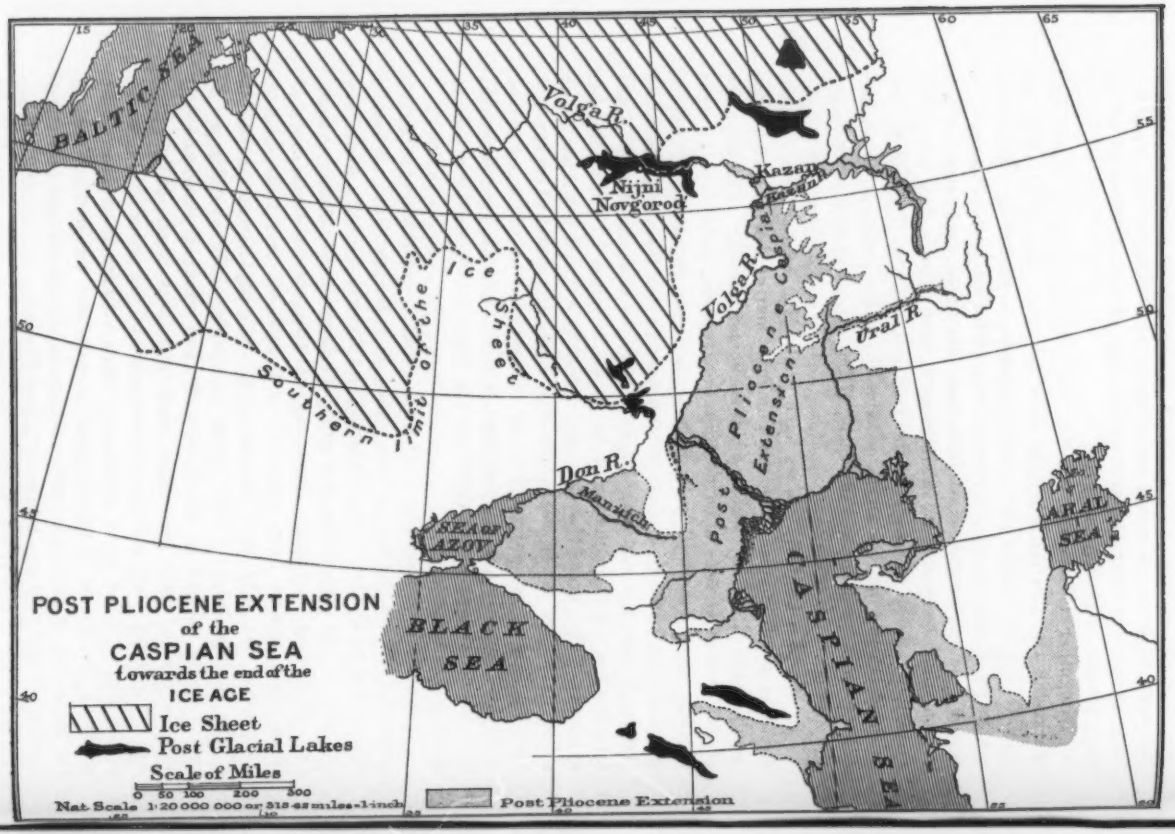
* Research Department, February 1, 1904.

the Lukchun depression, and, further on, the plains of Jungaria, were the seats of populous cities, monasteries, and villages. So, also, very large portions of the Gobi, and, in fact, most of the lower terrace of the high plateau of East Asia.

Altogether it is quite certain that within historical times East Turkestan and Central Mongolia have not been the deserts they are now. They have had a numerous population, advanced in civilisation, which stood in a lively intercourse with different parts of Asia. All this is gone now, and it must have been the rapid desiccation of this region which compelled its inhabitants to rush down to the Jungarian Gate, down to the lowlands of the Balkhash and the Obi, and thence, pushing before them the former inhabitants of the lowlands, to produce those great migrations and invasions of Europe which took place during the first centuries of our era.

In Western Central Asia we have in the lake Aral and the Caspian sea only small survivals of the immense marine basin which once occupied the place now taken by the Turkoman deserts. The evidence of the ancient Greeks and the Arab geographers, which was brought together some time ago by Prof. Oscar Lenz for the Russian Geographical Society, leaves, in fact, no doubt as to the fact that some two thousand years ago, and maybe much later, the Amu-daria entered the Caspian sea. But it may also be taken as proved by the Russian explorers of the Trans-Caspian region that it was not the Amu which rolled its waters so far westwards as to enter the present Caspian, but that the Caspian sea extended so far eastwards as to join what is now Lake Aral, spreading in its northern portion as far as Perovsk on the Syr (65° 30′ E. long.), and receiving the Oxus in its southern part in about 60° E. long.

However, it is not only to Central Asia, *i.e.* to the region which presently has no outflow to the ocean, that the evidence of recent desiccation is limited. In Southern West Siberia we have a striking evidence in the desiccation of a group of large lakes—Chany, Abyshkan, and Sumy-Chebakly. It so happens that we possess surveys of these lakes, dating from 1786, 1813–24, 1850–60, and 1880; and N. Yadrintseff has published these surveys. The rapidity of desiccation of the shallow lakes of this group is simply striking. Chany has been notably reduced in size during the last hundred years, and will soon be divided into two lakes, while the lakes Sumy, Moloki and Abyshkan have been reduced, in the course of the years 1850 to 1880, to the size of a few small ponds. A dozen villages have been built all along the shores of Chany, upon ground that was under water at the beginning of the nineteenth century, and eight villages now stand upon what was then the bottom of Lakes Abyshkan and Moloki. True, that according to recent information the lakes of this group have slightly increased in size; they apparently have reached once more the sizes


BALTIC SEA
Volga R.
Nijni Novgorod
Kazan
Volga R.
Caspian Sea
Ural R
Southern limit of the Ice Sheet
Don R.
Manytch
SEA of AZOF
Post Pliocene Extension
ARAL SEA
BLACK SEA
CASPIAN SEA
POST PLIOCENE EXTENSION
of the
CASPIAN SEA
towards the end of the
ICE AGE
Ice Sheet
Post Glacial Lakes
Scale of Miles
0 50 100 200 300
Nat Scale 1:20 000 000 or 315·42 miles-1 inch
Post Pliocene Extension

they had had in the middle of the last century; but they have not reached, and in all probability will never reach, the size they had at the end of the eighteenth century.

The same is true of Lake Aral. Owing to a period of increased rainfall which we have entered during the last few years, Lake Aral has began, since 1891, to reconquer parts of the shores which it had lately abandoned. Its waters, rising by nearly 4 feet during the past twelve years, have refilled parts of the gulf of Aibughir; but nobody expects, of course, that the lake should reach and cover once more, let us say, the marshes on the lower Syr, about Perovsk, which formerly belonged to the same Aral-Caspian basin.

Nor is desiccation limited to Asia. Abundant evidence is at hand to prove that in European Russia immense areas, formerly under lakes and marshes, have been laid dry. Thus it is known that when the Mongols invaded the territory of Russia in 1238, they could not reach Novgorod with their horses, because the northern republic was surrounded by impassable marshes, which only could be crossed in winter. The lifting of the land by an additional 16 or more feet during the eight centuries that have passed since the Mongol invasion, and the improvement of the drainage, which was due to the natural excavation by rivers of their channels, have thus dried to a great extent the marshes in the lake district of Novgorod. The same is true of the whole of Northern Russia. All historical evidence points, indeed, to the fact that seven or eight hundred years ago northern and middle Russia were covered with a far greater number of lakes and marshes than they are now.

The drying up of marshes, lakes, and rivers in Central and especially South-Eastern European Russia is also a fact that is mentioned everywhere throughout the seventeenth, eighteenth, and nineteenth centuries. It was attributed, of course, to the destruction of the forests; but, without denying that the destruction of the forests has a certain influence in the sense of reducing the amount of precipitation, and especially reducing the quantity of moisture which is retained in the soil after the thawing of the snow, we cannot but accept the conclusions of Boguslavsky concerning the Volga. He has proved by his pluviometric measurements that even the immense destruction of forests which took place for the last two hundred years in Russia, is absolutely inadequate for explaining the considerable reduction in the quantity of water that passes every year through the channel of the Volga, which took place during the nineteenth century.

2. It must thus be recognized that desiccation on a great scale has been going on in Northern Asia and Europe throughout the historical period; but it might be asked whether this desiccation is not merely a temporary fact; whether, in consequence of those fluctuations of which we know so many examples in Nature, the pendulum will not

soon begin swinging in the opposite direction, and the regions which have become deserts during the last thousand years will not soon begin once more to receive abundant precipitation and become fertile and flourishing once more. The fact is, however, that the desiccation of which we have testimony in historical documents, is only part of the desiccation which has been going on all over the northern hemisphere during all the geological period which we live in, *i.e.* the post-Glacial Period. The desiccation of Eurasia is not merely a physico-geographical, modern fact. *It is a geological fact*, which is entirely dependent upon the character of the geological epoch which preceded it, and must be considered in connection with it.

3. It has been established by the researches of the last fifty years that considerable portions of Eur-Asia were covered during the Ice Age with a mighty ice-sheet. Its southern limits in Central Europe and European Russia are now traced by the geologists approximately along the 50th degree of latitude, with "tongues" of ice which were protruding in Russia along the main valleys (Dnieper, Don) in a south-eastern direction, so as to reach the 47th or the 48th degree of latitude. In France, it has lately been proved that the whole of the Central Plateau and the Vosges were also covered with a thick ice-sheet. The glaciation of the northern portion of the Urals is no more doubted upon, and it is only the glaciation of the middle portions of these mountains which still remains a point of contest. As to the great West Siberian depression, it is now certain that during the Post-Glacial period, and probably also during the Great Ice Age, most of it was under the Arctic ocean, which reached, in West Siberia, roughly speaking, the 52nd degree of latitude, while in Eastern Siberia, which is covered with high plains, this same latitude was reached by narrow gulfs of the Arctic ocean now occupied by the valleys of the main rivers.

The low and broad watershed between the Irtysh-Ob and the Aral-Caspian depression surely must not have been glaciated, the more so, as in the south of that watershed the Aral-Caspian basin was spreading at that time eastwards. But it appears certain, on the other side, that very large portions of what the present writer describes as "the Great Plateau of East Asia" were covered with mighty ice-sheets. In all the border ranges and the Alpine regions which fringe the plateau on the north-west (the Tian-shan system, the Altai system, the western Sayans), traces of a wide glaciation have already been found by most explorers, and still more so in the highlands belonging to the same system further north and north-east of Lake Baikal (Patom Highlands, etc.). But if the border ranges which but little raise above the surface of the plateau have been glaciated, it is more than probable that large portions of the high plateau itself were glaciated as well, as also the high ranges of the Ektagh Altai, the Khangai, the Kentei, and so on, and that traces of this glaciation will be discovered (as they have been

discovered on the Central Plateau of France, after having been denied for a long time), as soon as the country is explored by persons competent in that branch of geology. Even now we can already say that to the north of the 50th degree of latitude the high plateau bears doubtless traces of a very extensive glaciation wherever it rises more than 3000 feet above the sea-level. Knowing, as we do now, the wide extension of glaciation in the Himalayas, the Tian-shan highlands, the Karakoram mountains, and the ranges Raskem and Peter the Great, and combining all we know about the structure of the surface deposits and the forms of the mountains on the Tibet plateau, we must presume that, in all probability, extremely wide areas in Tibet, now lying at altitudes of from 10,000 to 16,000 feet, were also under ice-sheets; while the comparatively low parts of East Turkestan and Mongolia ("the Lower Terrace of the East-Asian Plateau," in my classification) were probably at that time (or, at any rate, towards the end of the great glaciation) immense interior lakes, which received the drainage waters from the gigantic glaciers of the border ranges and the high plateau, before these waters found their way to lower levels through the south-eastern gorges of Tibet.

At any rate, remaining in the domain of *certitudes*, we can say that, with the exception of the lowlands of Siberia, which represented gulfs of the Arctic ocean, *nearly the whole of Eurasia, to the north of the 50th parallel, and a very large portion of the highlands in the south of this line, were buried under ice.*

4. What were the causes of such a glaciation, we don't know yet. All hypotheses, like that of Croll, which attempt to give an astronomical explanation of the Ice Age, on the supposition that periods of intenser cold were alternatively experienced in the northern and the southern hemisphere, must be received with the greatest caution, so long as no geological evidence of any sort has been brought forward to support the idea of an alternate glaciation of the two hemispheres. All the geological evidence we possess—that is, the complete similarity of aspect of the glacial deposits in both hemispheres, and the identical position they occupy with regard to the Tertiary deposits and the Tertiary volcanic eruptions—seems to point out, on the contrary, in favour of a simultaneous glaciation in both hemispheres; and so long, therefore, as the matter has not been gone into from this point of view, and alternation has not been proved, or even rendered probable, *by the geologist*, all speculation in that direction is misleading and hampering inductive research. Of all hypotheses hitherto proposed for the explanation of the Ice Age, the one which seems, in the present writer's opinion, to offer a *possible* cause, is the hypothesis of the great Swedish physicist, Prof. Arrhenius, based on the possible fluctuations in the percentage of carbonic acid in our atmosphere. The great volcanic eruptions which, we know, really took place towards the end of the

Tertiary period, on a gigantic scale all over the Earth's surface,* would fully explain why the percentage of carbonic acid in our atmosphere might have been increased; and we have seen ourselves, a few years ago, how one single eruption, that of Krakatau, by throwing out into the atmosphere considerable quantities of dust, was capable of producing a rather considerable effect, indicated by those wonderful pink sunsets which were seen all over the globe. The proper effect of volcanic eruptions going on on a great scale for a certain considerable time is not yet quite settled; and I am inclined to think, with Marchi ('Le cause dell' epoca glaciale'), that the ejection of considerable quantities of carbonic acid, vapour, and dust into the atmosphere towards the end of the Tertiary period may have been a sufficient cause for the subsequent lowering of temperature and glaciation. Besides, as has been indicated by Eugène Dubois ('Klimate der geologischen Vergangenheit,' 1903), who is supported in this case by A. Woeikoff, it is extremely probable that the very quantity of heat radiated from the sun does not remain invariable.

5. Whatsoever the causes of the Ice Age may have been, it is thus certain that considerable portions of Eurasia were buried under a thick ice-sheet, both in the north of the 50th degree of latitude and in the highlands of both Europe and Asia to the south of this line. It is also certain that towards the end of the Glacial period, and immediately after the retreat of the great ice-sheets, portions of Europe and Asia were under the sea. Leaving aside such doubtful cases as the shells found on Moël Tryfan, and accepting only absolutely doubtless evidence, we may say that all those portions of Western Europe which are now below 300 feet of altitude were under the sea. In Sweden the traces of post-glacial submergence are certain up to nearly the same level, or, at least, up to 250 feet. In Finland and in North Russia now-living shells are found up to the 150-feet and maybe 200-feet level along the Arctic littoral.

The Baltic sea entered, we now know, westwards into Sweden, and covered the region of the great lakes. The Gulf of Finland spread eastwards so as to embody Lake Ladoga, and the head of this gulf must have been separated by a narrow watershed only from the Arctic sea, which spread in Northern Russia as far as the Vychegda and the upper Pechora. In the valley of the Pechora the post-Glacial sea attained a level of 120 or 150 feet, and filled a long gulf stretched southwards. In Western Siberia a wide gulf of the Arctic

* In Asia they took place on a tremendous scale. I have found them, with the small craters of eruption still preserved amidst vast sheets of lava, in the West Sayans (Jumbulak-Oka valley), on the Vitim plateau, and to the east of the Great Khingan. Every recent explorer of East Asia has mentioned some new extension of eruptions of apparently the same age.

POST PLIOCENE EXTENSION
OF THE CASPIAN SEA
in the
ARAL CASPIAN DEPRESSION
after N. Konshin and other sources.
Post Pliocene extension
of the Caspian Sea.
Post Pliocene Lakes.
Scale of Miles
0 50 100 200
Nat. Scale 1:15,000,000 or 237 miles = 1 inch.
CASPIAN SEA
ARAL SEA
Ust Urt Plateau
KHORASSAN
Sir Daria
Amu Daria
Supposed Northern Channel
R. Ural
L. Volga
LAKE BALKASH
45
40
35
50
55
60
65
70
75
80

ocean penetrated almost as far as the line now marked by the Trans-Siberian railway under 50° N., while further east large tracts in the north of the Arctic circle, as well as portions of the main river-valleys, were under the sea, narrow gulfs of the ocean penetrating up the Yenisei and the Lena; and finally, the presence of fossils identical with those molluscs which now live in the Caspian sea testify that during the post-Glacial period the Caspian basin extended eastwards so as to include Lake Aral and large portions of what is now the Transcaspian territory, that it covered at the same time the steppes of the lower Volga, and that a gulf of the sea penetrated northwards up the Volga as far as Kazan and its tributary, the Kama.

6. When the ice-sheets which covered Eurasia began to shrivel and to thaw, immense quantities of water must have been discharged from this mass of thawing ice southwards, and the broad belt of land on the southern fringe of the ice-mass, now occupied in South Russia by Loess, must have been periodically inundated every summer with muddy rivers which covered the land with fine mud, and gave origin to *tundras* first and to prairies next, or to such *urmans*, or marshy forests, dotted with countless lakes, as we now see in West Siberia.

As to the space that had been under the ice-sheet itself, immense lakes were formed in its place as it was thawing, and these lakes attained vast sizes. The old drainage systems having been choked by the glacial deposits, immense territories had no drainage, and new channels had to be dug out in order to find an outflow for the waters towards the ocean. Innumerable traces of such post-Glacial lakes are found everywhere in Eurasia, wherever there are traces of glaciation. Consequently, I have proposed to introduce in geology a special term—*the Lake Period*—to designate the conditions which prevailed over immense portions of the northern hemisphere (in all probability of the southern as well) during the early portion of the post-Glacial period.

The American geologists have long since noticed this feature of the post-Glacial period, and they have tried to delineate the shores of some of the old lakes of that epoch, such as the now disappeared "Lake Agassiz." They are endeavouring, moreover, to reconstitute the drainage systems and the channels of the rivers of that interesting period, very much at variance from the actual systems of drainage. Traces of one such immense lake I have indicated in Europe, namely, in middle Finland—the whole of the area now covered by the countless large and small lakes of Central Finland having been once covered with one large lake with islands in it. Its level stood about 100 feet or more above the present level of the Saima system of lakes, and its southern shore was made by the great front moraine, or ås, followed by the Hangöudd to St. Petersburg railway, which runs parallel to the

shore of the Gulf of Finland, and is so prominent a feature on the map of the beautiful 'Atlas de Finlande.'*

7. That the whole of the surface which was covered with ice during the Ice Age must have been dotted with countless lakes of all possible dimensions when the ice-sheet had thawed, is self-evident for any one who has examined the landscapes of Alpine valleys during the retreat of a glacier, or has paid attention to the detailed topography of a formerly ice-bound landscape. Therefore traces of lakes which have existed after the Glacial period, down to relatively quite recent times, are found in countless numbers everywhere in Northern Europe and Asia.

The lowlands which surround the great lakes of Sweden are covered with deposits of lacustrine origin, and on the slopes of the Upsala ås and the other åsar we see, above the post-Pliocene marine deposits, thick layers of lacustrine deposits. The surface of Schonen is all dotted with smaller lakes, which, like the small high-level lakes of Finland, are only insignificant relics of the countless lakes which existed here in Palæolithic and Neolithic times. In Northern Russia, the Onega region, the Valdai plateau, the tundras of the Mezen, the Pechora land, the lake district of the western provinces, the marshy lands of the Pripet, the provinces on the upper Volga, vast tracts on the Vetluga, and the lower Kama, etc., are simply dotted with countless lakes, each of which indicates by the flat marshy shores which surround it as a wide fringe, that it only represents the deepest trough of a once much greater basin. I mention, as you see, only Russia and partly Sweden, because these are places of which I have a personal knowledge; but every one here present would be able to name from his own personal knowledge wide portions of these islands (such, for instance, as the immense lake which must have covered the valley between the North Downs and the South Downs), or in France, in Germany (the Seen-Platte of Prussia, etc.), which bear evident testimony of having been covered with lakes for a very long time after the thawing of the ice-sheet.†

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* I am aware that M. Sederholm is inclined to admit that the level of the Baltic sea rose once to that same level; but I have indicated to him that what he has described as old sea-beaches on the Yväskylä ås are parts of the great bottom moraine (*krossstensgrus*) from which the waves of the old lake have washed out the sand and small gravel, leaving behind the big stones; the deposits which I have described both on the slopes of this ås, and in many other places round the lakes, as also the deposits which were pierced by the Höytiänen lake during the well-known catastrophe, are entirely of a Lacustrine character. They contain, indeed, none of the shells which are found in such quantities as soon as you descend to a level of about 100 feet above the present level of the Baltic. Further inland the same deposits, undoubtedly Lacustrine, are found at a still higher level above the sea than on the Yväskylä ås, thus showing that after the thawing of the ice-sheet all Finland was covered with lakes, disposed terrace-like, up to the highest levels of the Kjöllen.

† It was always on the rims of such old, now totally disappeared lakes that my friend Polyakoff, who was reputed for his special gift of discovering stone implements

It would be most desirable, therefore, that a number of persons interested in this subject should begin to collect the necessary materials, so that we might some time hence prepare correct maps of the lakes of the Great Lake period.

In Siberia we should have very large territories literally studded on our maps with lakes if we only possessed detailed surveys of these regions. We have first the immense *Urman* region, watered by the Irtysh, the Ob, the Vasyugan, etc. Recent surveys represent it as an almost uninterrupted marsh, 1450 English miles wide and 500 miles long (north-west to south-east), intersected only with narrow ridges approximately dry enough to be inhabited. Then we have a territory, 200 miles wide and over 900 miles long (west to east), situated halfway between the above marshes and the Aral-Balkhash basin, which, according to latest surveys, appears literally studded with thousands upon thousands of small lakes. The aspect of this region, dotted with lakes on recent maps (such as Stieler's), is most edifying; but we should have the same aspect in several other places of Siberia if other parts of Northern Asia were mapped with the same details as this portion was lately mapped for the purposes of immigration. Thus, for instance, the Vitim plateau (the basins of the Tsipa, the Amalat) would have exactly the same aspect, so far as I could ascertain along the lines which were followed by Lopatin and myself. The map of North-Western Mongolia, even now, is in the same case; it is covered with a number of large lakes, but there are hundreds of small ones which have not yet been mapped. The high plains of the Vilui are again in the same case; so also the lowlands of the Sungari, the Usuri, and the lower Amur. All these are still in the Lake period.

In Central Asia we find wide regions bearing distinct traces of having been covered with immense lakes. Such are, the lake-region in Tibet, in the province of Khor, and, in fact, along all the hitherto explored routes; the immense marshes of Tsaidam; the Lob-nor depression, and, in fact, both the depressions which run in Chinese Turkestan along the foot of both the Altyn-tagh and the Ektagh Altai; the marshes and lake regions at the northern foot of the latter, etc.

However, all these now existing lakes are but only indications of the immense areas which were under lakes and marshes during the post-Glacial period. There would be no exaggeration in saying that the whole of the territory invaded by the ice-sheet must have represented, at the beginning of the post-Glacial age or the Lake period, immense

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by the bushel in so many places of Siberia, usually discovered traces of Neolithic human settlements. "There," he would say, as he looked upon some Siberian valley, "was the shore of the lake which once filled the valley. It's along that shore that they must have lived. There's a nice sheltered place; I am sure they must have liked it. Let us dig there." And in a few hours stone arrows and other implements were invariably dug out, sometimes bushelfuls.

marshes, exactly similar to what we now see in the above-mentioned basin of the Ob and the Vasyugan and lake regions, similar to that of Finland.

8. In proportion as the rivers dig out for themselves regular channels, and the drainage becomes more effectual (see, for instance, in my account of the bursting of Lake Höytyiänen, how the upper lakes are gradually emptied in Finland), and in proportion as the northern shores of Europe and Siberia are lifted up at the rate of from 1 to 3 feet per century, the desiccation of the whole of that territory necessarily goes on at a steady accelerated pace. In proportion as the outlets of the lakes dig their channels deeper and deeper, the surfaces of the lakes are diminished; the marshes which surround them are drained; chains of lakes become narrowed, as we often see it in Finland, and gradually a river is formed where formerly there was a chapelet of lakes. Later on, only the inundations which happen in the spring, or after extraordinary rains, will indicate the former position of the lake; but each inundation, owing to the mud it deposits, reduces the limits of the subsequent inundations, and meadows or bush-land spread over what was once the bottom of the lake.

Therefore, when we look at a chart of the soils of European Russia, prepared by Prof. Dokutchaeff and his followers, we see the whole of the once-glaciated surface of European Russia dotted with countless *marshes*, which, with the exception of a very few of recent origin, are remainders of former lakes. In some places the marshes cover immense surfaces; such are the marshes of the Polyesie, on the Pripyat and the Berezina, which cover 22,000,000 acres, *i.e.* a surface larger than that of Ireland. This surface represents, undoubtedly, the not yet quite dried-up bottom of a post-Glacial lake. Such are also the immense marshes of the Meschersk region of Ryazan, those of Vyatka, and of the Novgorod and Pskov lake region—the areas covered with marshes becoming wider and wider as we approach the coasts of the White sea and the Arctic ocean, so that in the provinces of Olonets everything is marsh, except the narrow ridges, or "pigs' backs," which slightly raise above the marshy grounds.

There is not the slightest doubt that where we see these marshes now, there were lakes in a geologically recent past. The finely alternating mud and sand deposits of these lakes are there to prove it, and when we examine a large-scale topographical or a geological map of Central and Northern Russia, we see all the possible gradations in the process of gradual desiccation which transforms lakes into marshes, and marshes into more or less periodically inundated meadows.

9. The deposits of numbers of elongated lakes, which all existed during the early post-Glacial period, but are completely drained by this time, are perfectly well seen on the geological and especially the soil-maps of European Russia. As to Asia, its surface is literally dotted

with post-Glacial lakes. On the smoothed surface of the Vitim plateau small lakes are found in countless numbers, and each of them is only the remainder of much larger lakes gone. Every cavity in the plateau, every valley in the surrounding mountains, bears traces of having been filled in post-Glacial times with a lake of large dimensions. The Alpine valleys of the Irkut, the Barguzin, the Muya, the Djida, etc., etc., are desiccated lakes, which now represent prairies, 20 to 30 miles long and from 5 to 15 miles wide, while on the surface of the plateau we see everywhere evidences of recent lacustrine deposits. Nay, even the low and smooth water-partings between the rivers of the plateau are still covered over immense areas with marshes. This is what the high plateau of Mongolia, and at a still more remote epoch the lower terrace of the plateau (Gobi and East Turkestan) must have been at the beginning of the Lacustrine period, and have been in reality, as is attested by the deposits of old lakes with which they are covered.

10. In short, over the whole of the surface of Europe and Asia, and especially over their northern or their more elevated portions, we find traces of a desiccation which is going on now, and has been going on all the time since the end of the great glaciation. It is not with a temporary fact that we have to deal. It is a geological epoch of desiccation that we are living in—an epoch as characterized by desiccation as the Glacial epoch was characterized by the accumulation from year to year of unevaporated and frozen precipitation. More than that, this epoch of desiccation is a necessary outcome of the preceding epoch of glaciation.

Nor is the phenomenon of desiccation limited to a small portion of the continent. It embraces the whole of the region that has once been glaciated. It is not only Central Asia that is desiccating; the same future is in store now for the Caspian steppes of the lower Volga and for South-Eastern Russia altogether. Desiccation in these regions becomes more and more apparent. But it cannot be attributed, as it is often done, to the destruction of forests in Northern Russia. We must see in it a geological fact, independent of the will of man; and while indicating this fact to men of science as an important line of future research, it would be worth while, at the same time, to think of the measures which should be taken for combating—at least within the limits of what is possible—the coming drought. Such measures, I mean, as tree-planting on a large scale in the menaced regions, with the aid of artesian wells, which seems to have given good results in North Africa, or any other measures which the knowledge of the danger and further research may suggest.

Sir Thomas Holdich (Chairman): I have received the following letter from Mr. Mackinder, who is unable to be present:—

"I have read with the greatest interest Prince Kropotkin's paper on 'The

Desiccation of Eur-Asia,' and should much have liked to have heard it discussed. I do not for one moment contest its general truth, and the marshalling of the evidence is admirable; but I am inclined to think that we may somewhat exaggerate the rapidity of the desiccation during the historical period. I have not by me now a copy of Sven Hedin's last book, to which Prince Kropotkin refers, but I read it with some care a few weeks ago, and, as far as I can remember, Sven Hedin is evidently not inclined to call in the aid of a general desiccation in order to explain the abandonment of human habitations in the Tarim basin and round Lob Nor. He attributes it in the main to the action of the wind, blowing over a very nearly horizontal surface, the effect of which is to carry the sand now to this side, now to that, for long periods of years, causing catastrophes to human settlements by suddenly changing the watercourses and the distribution of the lakes. Nor does the evidence appear to me sufficient that the invasions of Europe were caused by such a general desiccation. It is certain that the numbers of the migrants were small, and that their power was due in the main to their mobility—a mobility derived from the fact that they were nomads, and not settlers in their original home. The supply of them was continued for over a thousand years, and has been arrested since only by the action of the Cossacks. Our earliest Greek records clearly describe the nomadic habits of the peoples of the steppes, and there are indications of descents from Central Asia in periods long prior to the thousand years spoken of. Thus it appears to me that the desiccation cannot be described as having converted settled peoples on a great scale into nomads, and as then having driven them out of the centre of the continent. An adequate reason for the descents may surely be found in the opportunity of rich booty in the surrounding countries, and the leadership of such chiefs as Attilla and Ghenghiz Khan. But, I repeat, I am not contesting the general truth of Prince Kropotkin's thesis. I would only suggest some doubt of the rapidity and effects of the action as expressed in the second and fourth paragraphs of his first section."

So far as my own personal observations have gone in some parts of the country to which Prince Kropotkin has referred, I can fully support his theory of comparatively rapid desiccation. Certainly, in the Pamirs there is no doubt that the lakes which were measured some thirty years ago, during the Yarkand mission, by the geographers who were present with that mission, were very much diminished in volume when we saw them in 1896. The diminution of the size of the lakes was obvious; and it is not only in the highlands of Asia that we see signs of this desiccation. I have seen it very strongly marked indeed in Makran, which is by no means so high, where there is abundant evidence of a former good supply of water which must have been used for cultivating the fields by some of the migrants from Arabia a very considerable time ago. The remains of their system of storing water are obvious all over the country, but there could not possibly be any means now of securing water in the way they did then. All that must have occurred in a period that can certainly be spaced within, say, two or three thousand years. There is only one part of Prince Kropotkin's paper about which I should like to have a little more information, and that I dare say many gentlemen here can give me. I have always been taught that the age of the Himalayas is not the same throughout the whole range, and I thought the eastern part was far older than the western. In the north-western Himalayas nummulitic fossils are found at a height of something like 20,000 feet above sea-level, so that the whole of this part must be of comparatively recent formation. There is another point: glacial evidences have been found in the lowlands as well as in the highlands, and if I am not mistaken, there are evidences of glacial action even in the Rajputana desert. As regards Mr. Mackinder's

contention as to the rapidity of desiccation affecting the migrations of people from high Asia, I cannot help thinking that such rapidity has been quite sufficient to account for some of the migrations; simply because lands which were once well watered have clearly become dry and arid within historical periods.

Dr. Blanford: I have listened to the address of Prince Kropotkin with very great interest, and whilst I recognize the weight of his argument, I feel it requires very strong evidence before we can admit the rapid desiccation which is supposed to have taken place. I must say that my own experience is in favour of desiccation. Rather more than thirty years ago I had occasion to traverse Persia from Baluchistan to the Caspian, and I came back impressed with the view that the great plains of Persia, which occupy so very large a portion of the country, were the sites of ancient lakes. Some time after that, Dr. Tietze, who recently presided over the Geological Congress in Vienna, pointed out that the deposits in these plains were very similar to those that had been described by von Richthofen in Northern China, and that they were of the nature of loess, and consequently he inferred that they were of eolian, wind-carried origin, and not water-carried. For a long time I accepted this view, but I must say I am rather inclined to revert to my former opinion from the evidence that has accumulated of ancient lakes in various parts of Asia. And I think it is probable that if the deposits in those great plains were entirely eolian, their surfaces would not be so level as they are. The extreme levelness of the surface in general is rather what one finds in deposits from water than in any deposits from wind—at least, such eolian tracts as I have seen in Western India undulate to some extent. It is true they are coarser, with more sand. Quite recently Mr. Vredenburg, of the Geological Survey of India, has been in Western Baluchistan, and he was particularly struck with the great evidence that the country has been recently and rapidly dried up.

I do not wish to discuss the question of the glacial epoch, or its connection with the desiccation, but will merely say I am a little doubtful whether there was an ice-sheet all over Tibet, because I think if there had been, the evidences in the valleys of the Himalayas of deposits from the ice-sheet would be more extensive than they are. It is somewhat interesting in this connection to remember that the only great glacial epoch besides the Pleistocene of which we have any record, extending over a large part of the Earth's surface, is that which took place in Permo-Carboniferous times; and in the Trias, which succeeded, desert conditions prevailed extensively, so that, so far as the geological record goes, the evidence is rather in favour of a very cold period being succeeded by a dry one. There is one remark I should like to make in confirmation of what Sir Thomas Holdich has said as to the presence of marine Mesozoic beds on the Tibetan plateau. I am not sure I understood Prince Kropotkin's argument, but it is undoubtedly the case that marine Jurassic and Cretaceous beds occur in Tibet, and not only do well-marked Jurassic beds abound to the westward in many places, but they have recently been found on the plateau north of the eastern Himalayas. Marine or estuarine Cretaceous beds have also been reported north of Lhasa.

Sir Martin Conway: There is just one question I should like to ask, and it is based upon what happens in South America. Prince Kropotkin has not referred to the desiccation which is going on in a certain part of South America, and which is very similar to what he has described in Eur-Asia. It will be within the knowledge of most of you that, in the long high plateau of South America, the great Lake Titicaca and the neighbouring Lake Poopo have been very rapidly drying up within historic times. The old temple which was once on the shores of Titicaca is now a considerable distance away from it, and some height above the level of the waters. Dr. Moreno told me that he had observed somewhere on the borders of Bolivia and

Chili, at an altitude of 17,000 feet, the remains of cultivated fields now entirely abandoned. I myself saw at different places plenty of other traces of ancient cultivation at high altitudes. These fields were not abandoned on account of shrinkage in population, but for some other reason. Now, it is certain, I believe, that in South America no fields at a height of 17,000 feet can be cultivated. Dr. Moreno concluded that the abandonment of those fields was due to the great increase in elevation that had occurred within historic times in the district. That increase of elevation appears to apply to the whole of the central South American plateau—I mean the central belt of plateau that runs north and south down a considerable part of South America. There is proof enough of the great rapidity of elevation all over that part, especially in Peru and Bolivia. Along the Peruvian slope you can find shells of existing species on the hillsides at an altitude of 1000 or 1500 feet, and even higher; I have heard it said, up to 3000 feet. At all events, the fact of the rapid recent elevation of the plateau is admitted. The modern increasing desiccation of the plateau is due to that rapid elevation. The moisture comes in a steady drift from the east over the great Amazon plain and the low countries in that direction, and is precipitated upon the mountains. As the mountains increase in altitude and the belt of mountain country widens, so the rainfall on the actual plateau diminishes. Now, what I wish to ask is this: whether observations have been made tending to show that the great Central Asiatic mountains are now rising or have risen within historic times, as the South America mountain area has risen? I have not been able to hear of such observations; perhaps none have been put on record. If this great Asiatic area is still actually rising; if its great ranges are still going up, as the northern coast region is going up, only considerably faster—for it may be assumed that the greatest thrust and the most rapid rise are in the crinkles and not in the flat margins of a continent—then the damp air, coming as it does from the south, will have been more and more prevented from passing over the mountains and reaching the plains beyond. May not this be one reason for the observed desiccation of the Central Asiatic area?

Prof. SEELEY: I should like to ask whether the historical evidence of physical change is not much too recent an event to be connected in any way with the glacial period. The drying up of the surface has been put before us as counted in years, but the glacial period and all that attended it are so far off that no one would venture to limit the time when physical circumstances permitted of glacial conditions existing in a way that could perceptibly influence this area. The drying up of Asia has been interesting to those who had to deal, from the geographical or historical points of view, with Central Asia during past years. We had to consider the general question of desiccation and its causes from a comparative point of view. And, turning from a region brought before us to-day to the western portion of North America, there is desiccation perhaps more profound than can be paralleled in any part of Asia. By deep and long-continued erosion rivers have practically passed away, and lake-basins dried so that no sheet of water remained within them. The whole of this region, since the higher summits were levelled by the sea to plateau condition, has been undergoing a steady elevation. As the elevation has gone on so the desiccation has gone on. The geological evidences of elevation which the Tertiary deposits of the north of India furnish show, during the whole of the Tertiary time down to the Siwalik and latest deposits, a wearing away of rocks towards the north, accumulating a thickness of strata almost incredible. Elevation must have gone on continuously during the Tertiary period, and therefore at the present time we probably see nothing but a steady continuation of the same process, an intensification of those plications of the Earth's substance which produced earlier upheavals. If you can account for the elevation of the land,

which in another portion of the globe is associated with desiccation, it would be well to inquire, before formulating any final conclusion, as to why we should not consider whether the upheaval of the land is not the main cause of the drainage of the water from off it, and the diminished supply; whether the upheaval of the land does not necessitate the gradual cutting down of channels, by means of which the water escapes from the land, so that the land has become dried up and conditioned, as our paper so excellently puts before us. Consideration of the life of the Caspian and its essential differences from the life of the Black sea region on the one side preclude any conception of a recent connection between them, and facts with regard to the mammalian life of the Caspian point towards the Arctic region for near affinities. The very circumstances that may have caused the drying up of Central Asia, that is the uplifting, of necessity involves undulatory folding of the land, and we may not assume that the relative levels of the different parts of the surface of Asia remained the same from early times to the present day.

Mr. Douglas Freshfield wished to present a few facts which, in his opinion, were inconsistent with the opinion expressed by the lecturer that there had been a progressive desiccation of Europe during recent historical times. No one could doubt that within a comparatively recent geological period there had been a great shrinkage in glaciers, and such a shrinkage was a visible sign of desiccation. His remarks were limited to historical times—to the last 3000 years. During this period he failed to find in historical records or in local facts any signs of desiccation. There had been a temple in Roman times on the top of the Great St. Bernard. This would have been impossible had the snow-level been 1000 feet lower than it is now. The Lower Glacier of Grindelwald, in 1854, covered a quarry, since disclosed in its retreat, which had been used for building at Bern two centuries before. Oscillation, not desiccation, in climate was what all records pointed to. Much light had been thrown on the subject by the writings of Richter, Forel, and Rabot. The first named had attempted to connect the movements of glaciers with Bruckner's twenty-five-year periods of rainfall. His views were questioned. It was generally held that there were secular movements, within which were minor oscillations. The last general advance was from 1700 to 1855. At present we were in a period of marked retreat.

Dr. J. S. Flett: There are many points in this paper which are of the greatest possible interest to the geologist, and especially to the British geologist. We have, in the northern part of the British Isles, a large amount of evidence which points to a gradual amelioration of the climate and a gradual desiccation. It is interesting to find nearly all these lines of evidence can be supported by facts from northern Eur-Asia and from the northern half of North America. There is one fact which proves that within comparatively recent geological times the climate of Scotland has gradually improved in the matter of dryness. Over large parts of the higher grounds there are great expanses of hill peat, the hill peat growing on the gentle slopes of the hills, and being distinct from the peat which we find in old lakes and alluvial flats. This is certainly wasting away. It is much cut open, and is being blown away by the wind. It is not in the condition of growth; it is growing in the bogs, but wasting away on the hilltops. Before we come to that conclusion we must eliminate other factors. The presence of sheep leads to the cutting of drains, in that case the peat is exposed to drought in summer, and is apt to be blown away; but when these hills go back into deer forests, we may often see that the peat begins to grow again, or at any rate heals over and the waste is less rapid. It is quite clear the peat was formed under conditions no longer in existence, and is wasting away at the present time. The conditions in those parts of the world where the growth of peat is very rapid, are a moist climate and a comparatively cold temperature.

There are other points. The rivers necessarily flowed in much greater volume at the close of the Glacial period. We have the evidence which is furnished by the Arctic plants which are found in many dried-up lakes, and of the vast number of obliterated lakes which are dotted over the surface of Scotland. These are not necessarily proofs that the climate was wetter than it is at the present day, for the existence of lakes was really due to an incomplete development of the topography. Some of the evidence which has been adduced to-day of the gradual shrinkage of the lake-basins might be accounted for by sedimentation. It is inevitable that lakes should gradually become silted up. In fact, the mere number of old lakes in North Britain is no clear proof that the climate is improving. Any one can examine the maps for himself, and he will see in some of the Highland sheets of the Geological Survey of Scotland that there are hundreds of silted-up basins.

I should like to draw attention to a few facts which Prince Kropotkin has not mentioned. The Glacial period was not simple. Gradually the conviction has spread among the geologists of America and Europe that Glacial periods alternated with inter-Glacial periods. We know by the researches of Mr. Clement Reid that the inter-Glacial periods were characterized by temperate floras. The number of Glacial periods is at present differently stated. We may be sure that in the British Islands there are at least three. The two last were comparatively recent. Neolithic man in Britain probably saw the Highland glaciers occupying the valleys, but how far this change in climate has taken place rapidly I have really very little evidence. The earliest historical records in Scotland are too imperfect for us to say whether the climate has improved or has become stationary. The cause of these changes I should look for in some wide operating influences which affect the whole of the northern hemisphere. I doubt very much whether the varying percentage of carbonic acid in the atmosphere, which has been mentioned by Prince Kropotkin, is sufficient to explain the facts. We must have some explanation which explains not only the difference of climate, but the repeated alternations. Although of late years the astronomical explanation has fallen to some extent into discredit, yet I do not think it is altogether disposed of. Even within the last twelve months mathematical papers have appeared showing, at any rate, that this theory may account for the Glacial and inter-Glacial recurrences.

Dr. H. R. Mill: I hardly like to take up time at such an advanced period of the afternoon, but so much has been said on the geological side of this geographical question, that it is only right some attention should now be called to the meteorological aspect. I think we may take it for granted, or take it as proved, that the amount of water-vapour in the atmosphere as a whole has remained the same during all historical time. So long as the existing ratio of lands and seas continues, I do not think there can be much room for any fluctuation in the actual amount of evaporation and condensation over the Earth's surface as a whole, and any local desiccation would appear to be a case of unequal distribution. If the plateau regions of all the continents are undergoing desiccation, as seems probable, there must be an increase of precipitation in some other parts of the world. With regard to the theory of uplifting, which is certainly the most reasonable cause to adduce for the diminution of precipitation in the interior of a continent, a difficulty presents itself in the case of Australia, where we have desiccation in the interior where there are no great mountain ranges barring off the sea-winds. The Sahara presents a similar difficulty, and to some extent South Africa also. What I should like to know is, whether there is any possible way, apart from the mere former existence of inhabitants, of ascertaining if there has been a higher rainfall in past times in the arid area, or if there has been an increase of evaporation. The only indication, it seems to me, which can be taken for the desiccation of a continent or

any tract of country is the formation and disappearance of salt lakes, *i.e.* lakes which have no outlet; not the changes in fresh-water lakes, which may be created or destroyed by various surface changes irrespective of change in precipitation or evaporation. As regards any secular diminution of the rainfall, at any rate in those parts of the world where records have been kept for one hundred years, I do not think any case whatever has been made out. There are wet spells and dry spells, succeeding each other in a sort of halting rhythmical progression. It is quite likely, in those periodical rises and falls, the amount of precipitation may occasionally rise higher and fall lower, and so give longer periods of more severe rain or more acute drought. At present all opinions on the subject are largely speculations, for the records do not go back far enough. I can only hope, in the course of another century or so, with the development of the very excellent meteorological system which the Russians have introduced in the heart of Asia, there will be some more definite evidence on the subject to bring before the Research Committee.

Dr. Evans: Prince Kropotkin's theory that the migration of nomads into Europe from Central Asia was due to the desiccation of Central Asia reminds me of the stories I heard when in Southern India of the great famine of 1877, how the peopled travelled in thousands to the eastern hills, where there is never a complete drought, in hopes of getting food. The general question of a possible desiccation of the whole world, or even of the entire northern hemisphere, is quite distinct from that of the drying up of Central Asia, to which the author has drawn our attention to-night. Recent changes in the physical geography of the latter region rendered inevitable the desiccation of the country. Formerly there was a large area of sea in the north and east, but by the elevation of the land this has now become dry, and the only water available for furnishing moisture is in the extreme north, where there are Arctic conditions, and the evaporation is at a minimum. On the south the Himalayas have been and are rising. Recent earthquake shocks were almost certainly connected with the elevation of the range, which has long been recognized. The relation of the desiccation of Asia to the rise of the Himalayas is referred to in the 'Manual of the Geology of India,' second edition, p. 486, 1893. I may also mention Mr. F. W. Harmer's suggestion, that south-east winds used to be more prevalent in eastern Siberia (*Q.J.G.S.*, vol. lvii. pp. 422–429, 1901). If that were so, it would have tended to make the climate more humid than at present.

Prince Kropotkin briefly responded. He was very thankful to all those who took part in the discussion for their remarks, which threw so varied a light upon this wide subject. He was especially thankful to the Chairman and Dr. Blanford for their remarks concerning the finds of Tertiary and Cretaceous fossils on the northern plateau slope of the Himalayas, as they touch upon an extremely interesting question of mountain-building. That the lifting up of the Himalayas took place during the Tertiary period, and maybe since, is, of course, a fact. But how far "inland" does spread that zone of lifting up which, according to Dana's theory, would result in the formation of a border-range along the coast of an ocean? So far as present information goes, it seems that no fossils of a more recent age than Devonian have been found on the plateau beyond its outer fringe, but further information in that direction would be most welcome. As to the remarks of Mr. Freshfield, fluctuations in the sizes of glaciers do not explain the facts observed by geologists. The glaciation of Middle Europe and Middle Russia is now a fact recognized by the Geological Surveys of those respective countries. So is also the post-Pliocene extension of the Caspian sea, in the limits indicated by the presence of Caspian now-living shells, while all the great valleys of the Caucasus bear traces of large lakes which have existed at a, relatively speaking, recent epoch.

THE CHAIRMAN: We have concluded a most interesting discussion, and I think that if there is anything more to add to what has already been said, it had perhaps better be adjourned to a time when a paper will be read by Dr. Evans on a subject which is somewhat analogous. I have now nothing more to do than to ask you to join me in thanking Prince Kropotkin for starting such a very interesting discussion.

THE NATIONAL ANTARCTIC EXPEDITION.*

CAPTAIN COLBECK ON THE RELIEF EXPEDITION.

THE President has received the following communication from Captain Colbeck with reference to the work of the second Relief Expedition:—

"The good news of the *Discovery's* release and return to New Zealand must have reached you at least a month before you get this, but I hope I am not too late to congratulate you and tell you how delighted we all are that everything has turned out so satisfactorily, and that Scott will go home triumphantly in his own ship. He has done such excellent work during his second season, and they are all so fit and well, that I should say that their detention was the best thing that could have happened for the success of the expedition.

"The *Morning* left the Derwent on December 6, with light southerly and south-east winds, and had a very tedious run down to the pack, which we fell in with in 66½° S. lat. and 179° W. long., about 60 miles further north than last year. We entered it to the eastward of our old track, and then struck out to the south-west until to the south'ard of Scott island (sighted on December 26), whence we made an almost due south course until we reached open water in 70° 22′ S. lat. and 177° E. long. at 7 a.m. on January 1. The ice was totally different to what we had to deal with last year; very little screw ice was seen, and from first to last it was practically what you would call 'sailing pack.' We only stopped twice, and then it was more on account of the coal consumption, and my desire to save as much as possible for the *Discovery*, than the state of the pack. I found last voyage that we did no good by working under full steam in westerly and south-westerly winds of any strength, as the ice closes up in a breeze, and the gain is not commensurate with the expenditure of coal; whereas by waiting a few hours, or a day if necessary, for calmer weather, one can often make a good run on a minimum consumption of coal. On the second occasion when we stopped, we got a sounding of 1967 fathoms in 69° 23′ S. lat. and 178° 22¾′ E. long. We had only about four and a half days' actual steaming in the pack, which speaks volumes for the difference of seasons down south. I could scarcely realize, when we were passing through the Ross Sea, that it was here that we had such a rough time last year.

"My men were, I think, disappointed with the conditions we met, and

* Map, p. 812.

on one occasion I heard the look-out man, when being relieved, tell his relief to 'keep a sharp look-out for flying fish; this ain't the Ross Sea, it's more like the Mediterranean.' He was not very far wrong in his remark; I never saw more perfect weather than we had from the southern edge of the pack until we reached Beaufort Island. Light variable airs and calm, an absolutely open sea, the sun day and night, and scarcely a cloud in the sky. It was a most delightful run, and the evening lights on the high peaks and glaciated slopes of Victoria Land made a picture such as can only be seen in such latitudes.

"We passed Cape Adare on the evening of January 1 at a distance of about 95 miles, and then steered for Coulman Island. We saw a little pack close inshore north of Coulman, but nothing in the open sea. Steering to the south-west, we crossed our last year's track *in open water*, and landed on Franklin Island January 4, ten days earlier than last year, and not a vestige of ice to be seen. I then decided to miss out Crozier, and make for McMurdo Strait direct. We met with loose pack between Beaufort Island and the western mountains, but had very little difficulty in forcing our way through, and at noon, January 5, we were brought up at the edge of the icefield, 18 miles north of the *Discovery*.

"The position of affairs in McMurdo Strait was a severe blow to us, but the open state of the Ross Sea, which was, if anything, more free from ice than when the *Discovery* passed down, gave us such hopes of success that we never lost hope during the six weary weeks we spent at the ice-face. Scott and Wilson were in camp at Cape Royds, and boarded us a few hours after we arrived. They both looked exceptionally well. Scott was very much upset when he read the imperative orders to abandon his ship if unable to get her out this year, and spent a very miserable time in consequence until his ship was actually afloat.

"We had a pleasure cruise through the pack this year, but we certainly made up for it in McMurdo Strait; I think it was the worst six weeks I ever remember. Our spirits went up and down like a thermometer, according to the amount of ice that broke away each twenty-four hours. Blasting was carried on almost continuously during our stay there, with very good results. It is difficult to say how far it assisted the end we had in view, but there can be no question of the moral effect; it kept all hands employed, and every piece we broke away took us so much nearer the *Discovery*. On February 13 we had about 2½ miles of ice between the two ships, and on the following day we reached the *Discovery's* winter quarters. I must leave you to imagine the scene as we steamed into the harbour; every one was wild with excitement and enthusiasm, and made no attempt to hide it. In after years, those last two hours of February 14 will be my happiest Antarctic reminiscence.

"On February 16 the *Discovery* floated and swung to her anchors, and by 5 p.m. of the 19th all coal and stores had been transferred, and we

started northwards in company. We kept company as far as Wood Bay, where I left them, and proceeded on my way here. Captain Scott wished me to accompany him as far as Cape North, and although I should have liked to do so very much, I thought it better to give him all the coal I could spare and come north under sail, reserving only sufficient coal for emergencies. Scott would not have this at first, as he thought it was not fair to me, but after explaining that the *Morning*, being a much slower ship under steam than either the *Discovery* or *Terra Nova*, might only hamper his movements, he accepted the 25 tons of coal I offered. The *Terra Nova* could only give him 55 tons; she evidently burns much more coal than we expected. She had over 500 tons on board on leaving Hobart, and Captain McKay reckoned that he would be able to give the *Discovery* 100 tons. I relied on this, and only took 250 for my own consumption, whereas I had 300 tons leaving last year.

"After leaving Wood Bay, we had nothing but head winds and heavy westerly and north-westerly gales. The persistency with which the wind kept in the north-west quadrant was marvellous, and made our passage to here very long and tedious. The *Morning* sails very well, but one cannot expect her to beat to windward in such weather as we had, and a light ship; and our supply of coal, which had also to act as ballast, would not admit of continuous steaming. We arrived off Auckland island on March 17, but westerly and north-westerly gales prevented us from coming in until Sunday the 20th; the *Discovery* had arrived some days before, and the *Terra Nova* on the 19th. We are now busy getting ballast on board, and will proceed as soon as we are in sea trim for the trip up to New Zealand.

"I'm afraid we shall have a heavy repairs and renewals list this time, both on deck and in the engine-room, and it is a considerable relief to me that this expense will not fall on the R.G.S. We had our starboard whaleboat swept away and the bridge severely damaged by a heavy sea in 64° S. Mr. Doorly was on the bridge at the time, and got a nasty fright; he thought the whole affair was coming down.

"The doctor and Mr. England have got a very representative collection of birds and seals, and, profiting by their last voyage's experience, have taken steps to prevent the loss of seal-skulls this season. Mr. Doorly has kept the meteorological log very carefully throughout the whole voyage, and has also had charge of the stores. Mr. Evans, in addition to his ordinary duties, had charge of the hauling parties when transferring the *Discovery's* records and collections, and also took over the blasting operations when working through the last 6 miles. Mr. Morrison has nursed the engines in a most creditable manner, and got most marvellous results out of them when we found ourselves in a tight corner in McMurdo Strait. We had to keep steam up during the whole of our time there, so that any repairs necessary had to be executed under very trying conditions. I am pleased to say that Mr. England

has quite recovered from his accident, and was invaluable to me as chief executive. He is the most energetic and indefatigable worker I have ever met.

"The *Terra Nova* kept company with us until we reached the ice-face. The two ships' companies worked together in perfect harmony, and Captain McKay gave every assistance in his power at all times. I will send you a tracing of our track to and from the Antarctic, and also copies of the photographs taken; the latter will be developed in Christchurch, and may not be ready for the first mail after our arrival. All on board are in good health, and we have had no serious cases; in fact, we might say we have had no sickness at all. With kindest regards to Lady Markham and yourself, and hoping that you are both in the best of health.

"Port Ross, Auckland Island, March 24, 1904."

A BATHYMETRICAL SURVEY OF THE LAKES OF NEW ZEALAND.*

By KEITH LUCAS.

Waikaremoana.

Waikaremoana lies at the southern border of Tuhoe Land, 25 miles from the sea-coast of Hawkes bay. The land which lies between the lake and the sea-coast is intersected by irregular ranges of hills, increasing in height as the lake is approached, but nowhere reaching 2500 feet above sea-level. At a distance of about 2 miles, however, from the south-east side of the lake there begins a rapid upward slope, which culminates in a long ridge directed 25° north of east, in which the highest point, Puketapu, lies at an elevation of 3905 feet. This ridge, which is about 18 miles in length, is formed at its more western end by the Panekiri range, and at its eastern end by a similar range, which culminates at Ngamoko with a height of 3644 feet. Between these two ranges there is a break at Onepoto, where the land falls to 2015 feet, the level of the lake.

The north-west slope of the ridge, that directed towards the lake, is a very rapid one, the fall of nearly 2000 feet from Puketapu and Ngamoko to the lake's surface taking place in a horizontal distance of about $1\frac{1}{4}$ mile. In the case of the Panekiri range the fall is accomplished at first by a precipitous cliff of rock, below which a long wooded slope leads to the water's edge. The remarkable outline of this buttressed cliff forms the most striking characteristic of the scenery which the lake affords (cf. Fig. 3).

The valley occupied by the main body of the lake runs parallel to

* Continued from vol. xxiii. p. 660. Map, p. 704.

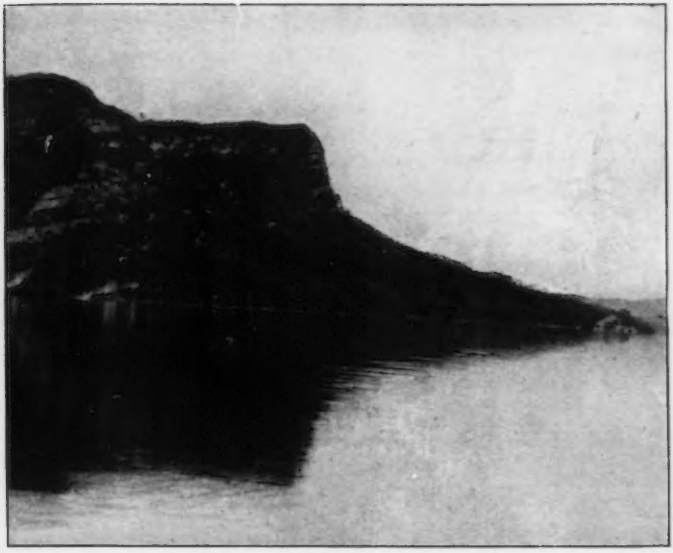

FIG. 3.—NORTH SLOPE OF THE PANEKIRI RANGE, WAIKAREMOANA. ON THE RIGHT-HAND SIDE OF THE PHOTOGRAPH A WOODED SLOPE IS SEEN LEADING DOWN TO THE WATER; ON THE LEFT, THE CLIFF DIPS STRAIGHT INTO THE WATER.

FIG. 4.—ROCKS NEAR ONEPOTO, WAIKAREMOANA. THE OUTLET OF THE LAKE IS SEEN ON THE RIGHT-HAND SIDE OF THE PHOTOGRAPH.

the Panekiri range for a length of 7¼ miles, measured in a straight line. Two arms run out from this valley from its opposite sides, about midway between its extreme ends. One of these, which projects towards the south, is very wide at its mouth, and leads to the outlet of the lake at Onepoto; the other, formed by the Whanganui and Mokau inlets, is far narrower, longer, and more clearly defined, and receives four of the largest rivers which enter the lake. The greater part of the lake, that part to which the name Waikaremoana is strictly applied by the Maoris, is thus seen to have the form of a cross, whose axes measure 7¼ and 6¼ miles in length. The remainder of the lake is called Wairaumoana. It is a narrow valley, nearly 5½ miles long, directed approximately north-east and south-west, and connected to Waikaremoana by a passage half a mile in width, known as the Straits of Manaia. On the north-west side of Wairaumoana, near its middle point, there enters a small valley, forked at its upper end, known as the Marau inlet. The area of Waikaremoana is 14·7 square miles, that of Wairaumoana 6·1 square miles.

The Panekiri range and its eastward extension through Ngamoko form the south-east boundary of the lake's catchment area. The whole area has the form of a triangle, one angle of which closely embraces the southern extremity of Wairaumoana, while the two sides adjacent to that angle skirt the western shore of Wairaumoana and the southern shore of Waikaremoana. The greater part of the catchment comes from the north and north-east sides of Waikaremoana, where a large extent of country broken by irregular valleys lies between the lake and the Huiarau range. Two points of considerable height, Maungapohatu (4353 feet) and Manuaha (4603 feet), form the limit of the catchment area in this direction. There is a small lake, Waikareiti, lying to the north-east of Waikaremoana, and sending its water into the east end of the larger lake.

Though the mean gradient from the Panekiri range and from Ngamoko to the lake's surface is so rapid, yet the slope which leads immediately to the shore is in general not extremely steep. The one marked exception to this is found along the shore which lies between Onepoto and Ohiringi; here the fall is accomplished by a single cliff dipping straight into the water (cf. Fig. 3). West of Ohiringi the same cliff continues, but falls back from the water's edge, and is buttressed by the wooded slope to which reference has already been made. In other parts of the lake such cliffs as do occur are of no great height, the largest being, perhaps, that which forms the east side of the Whanganui inlet. Elsewhere the shore is bordered by slopes covered from the water's edge with dense forest.

The immediate shores of the lake are in most parts formed of irregular masses of rock, though bare earthy cliffs occur in some places, chiefly in Wairaumoana and the east side of Waikaremoana. Swamp

and vegetation fringe the shore comparatively rarely, chiefly where shallow water occurs off the mouths of small streams.

The masses of tumbled rock lying round the outlet at Onepoto present a remarkable appearance (cf. Fig. 4), giving the impression that the level of the outlet must have been at some time raised by a great slip of rock at this point. In this connection it is interesting to note that part of the outflow always passes by underground clefts directly below the surface course, and reappears through the side of the hill in several places a few hundred yards below Onepoto. During the winter these underground passages do not suffice to carry the whole of the outgoing water, and there is a strong flow over the surface course. In summer, however, the latter may become completely dry, and the water appearing from the clefts on the hillside enters a system of confluent streams, which join below to form the Waikare Taheke.

The sounding of Waikaremoana was carried out between August 14 and September 10, 1902. Through the kindness of the chief surveyor of roads at Napier, we were permitted to use a large whale-boat belonging to the Department of Roads. This boat was manned by a crew of four Maoris, and was used for all the work which was done on the lake. It was found possible to work each division of the lake from one camp, that in Waikaremoana being near Onepoto, while that on Wairaumoana was on the east shore near Te Ure-o-Patae.

Soundings had been previously made in Waikaremoana on two occasions, as appears from the records kept at the District Survey Office at Napier. In the first place, there is a plan dated March 3, 1896, by Chas. Clayton, surveyor, showing 36 soundings, with a maximum depth of 840 feet in Waikaremoana, and 340 feet in Wairaumoana. A second record, a report by T. H. Strauchon, road overseer, dated October, 1896, speaks of soundings having been taken every five minutes between Onepoto and Tikitiki; with this report there is a sketch showing twelve soundings, on a line almost identical with one of those made by Clayton, with a maximum depth of 836 feet.

The outline of the plan which accompanies this paper is drawn from a lithograph, on the scale of 80 chains to the inch, dated May, 1897. On it are shown only those soundings which were made in 1902. Contour-lines have been drawn within the lake at intervals of 100 feet of depth. From these it appears that the basin of Waikaremoana is an extremely regular cone. The greatest depth recorded is 846 feet, which occurs within a depression having an area of 1·3 square mile, all exceeding 800 feet in depth. This depression sends out four tongues corresponding to the four valleys in which the lake lies. The longest tongue is that which is directed west; it approaches within about half a mile of the entrance to the Straits of Manaia.

The 700-feet depression, whose area is 2·7 square miles, follows still more closely the surface form of the lake, sending one tongue northwards

well into the mouth of the northern inlet, and entering far more deeply than the 800-feet depression into the east and south arms. The 600-feet and 500-feet lines behave in the same way, and call for no special description. The area of the 400-feet depression is 7·24 square miles, approximately half the surface area of Waikaremoana; it enters deep into the Whanganui inlet, even passing the narrow part of that arm, and sends a tongue also into the Straits of Manaia, through failing to enter Wairaumoana.

The remarkable regularity of the Waikaremoana basin is clearly indicated in the following table, which shows the areas included between successive contour-lines :—

Area of mean depth,	50	feet	...	...	2·22	square miles.
"	"	150	"	...	...	1·97	"
"	"	250	"	...	...	1·79	"
"	"	350	"	...	...	1·48	"
"	"	450	"	...	...	1·24	"
"	"	550	"	...	...	1·48	"
"	"	650	"	...	...	1·44	"
"	"	750	"	...	...	1·48	"
"	"	820	"	...	...	1·3	"

From this table it appears that from the deepest water to the 300-feet line the areas enclosed between successive contours are almost identical, while from the 300-feet line to shore there is a gradual increase in the successive areas.

The basin of Wairaumoana continues that of Waikaremoana without interruption. The general slope in the former is downward from all sides towards the Straits of Manaia, near which the deepest sounding, 375 feet, occurs. The 300-feet depression reaches from the Straits of Manaia to a point about halfway down Wairaumoana, where it appears to end bluntly at the foot of a curious shoal, on which a depth of only 72 feet was found. Excepting the interruption caused by this shoal, the contour-lines conform fairly closely to the surface outline of the lake. The areas which successive contours in Wairaumoana enclose are tabulated below; they show an increase as the shallow water is approached.

Area of mean depth,	50	feet	...	...	1·87	square miles.
"	"	150	"	...	...	1·66	"
"	"	250	"	...	...	1·54	"
"	"	340	"	...	...	1·04	"

There are no islands of considerable size in Waikaremoana; in Wairaumoana there are four, having an aggregate area of one-tenth of a square mile. All the islands are in close connection with the shore, none lying outside the 100-feet contour.

The mean depth of Waikaremoana, calculated from the contour-lines, is 397 feet, that of Wairaumoana 175 feet; or, expressed as percentages of the maximum depth in each case, that of Waikaremoana is 47 per cent., that of Wairaumoana 49 per cent.

Lakes of the Middle Waikato: Waikare and Whangape.

At some 45 miles from its mouth, and shortly after its junction with the Waipa, the river Waikato breaks through a chain of low hills and enters a broad plain. In its course through this plain the river is flanked on either side by a series of shallow lakes. The more important of these are Waikare and Kimihia on the east side of the river, and Whangape, Roto Ngaro, and Wahi on the west.

Lake Waikare lies close against a range of hills which forms the eastern limit of the plain (cf. Fig. 5), and it is separated from the Waikato river by a strip of low land $1\frac{1}{4}$ mile in width at its narrowest part.

The lake has an area of 10·7 square miles. In shape it is a rough parallelogram, with diagonals measuring $6\frac{1}{2}$ and $4\frac{3}{4}$ miles, the longer of these being directed north-west and south-east. From the west side of the lake there projects a peninsula, which divides the water into a larger north and a smaller south basin, leaving a channel a mile in width between them.

The form of the lake-basin is extremely simple. Over the greater part of its area the bottom is almost level, the water varying in depth only between 8 and 9 feet. From this level the slope is very gentle, until a depth of 6 feet is reached, and more rapid from that point to the shore. The gradients are throughout more gradual to the west, where the land is low, than to the east, where the hills rise immediately from the water's edge.

In the northern basin there are two islands, lying together on an extension of shallow water which deflects the 6-feet contour outwards from the southern shore. The larger of these, Motu Nuia, rises some 30 feet above the level of the lake, the smaller not more than 5 feet. There are also two small islands in the channel between the two basins, and yet another in the south basin, all of these lying between the 6- and the 8-feet contours. In the north basin, between the same contours, there occurs an area of shallow water where the least depth is 2 feet 6 inches.

The western shores of the lake are low throughout, often swampy and ill-defined. Swamp extends, for example, for three-quarters of a mile inland between the two creeks, Te Onetea and Rangiriri. Marshy land also divides the peninsula practically into two islands, between which the land is so low that a canoe can pass over it in flood-time. To the east, and in less degree to the north and south, the rise of the land is more abrupt. At some points along these shores there are precipitous earthy cliffs. The cutting away of these cliffs by wave-action goes on with considerable rapidity, to some extent by the formation of caves at the water-level, followed by subsidence of the overlying earth. One such cave which existed on the north shore in 1902

FIG. 5.—THE MIDDLE WAIKATO. LAKE WAIKARE LIES ON THE LEFT, BETWEEN THE RIVER WAIKATO, WHICH IS SEEN IN THE FOREGROUND, AND THE HILLS WHICH FORM THE BOUNDARY OF THE PLAIN.

FIG. 6.—TE ONETEA, THE STREAM WHICH CONNECTS LAKE WAIKARE WITH THE WAIKATO RIVER.

measured 4 feet in diameter at the mouth, and extended 18 feet into the cliff.

The catchment area of Waikare is extremely small. The Matahuru, the one stream which it receives, drains only a single valley of insignificant size. The outlet is by the two streams Te Onetea (cf. Fig. 6) and Rangiriri. When the Waikato is low, these two streams actually serve as outlets for the lake, but a slight rise in the level of the river is sufficient to reverse the current in them. In this way the Waikato serves as the chief source of water for the lake at certain seasons. During rainy weather the changes of direction in Te Onetea may occur with considerable frequency. I have, for example, observed three successive changes of direction in the current of Te Onetea within three weeks.

Of the two creeks, Te Onetea and Rangiriri, the latter is of less importance, being small and much choked by willows, Owing, however, to its joining the river at a lower level, it sometimes serves as an outlet to the lake at a time when Te Onetea is serving as an inlet. Since the current in Te Onetea runs into the lake only during times of heavy rain, the water which enters by this way is always heavily charged with suspended matter. There is, consequently, a considerable deltaic formation in the lake at the mouth of the stream, marshy land covered with low bushes extending for several hundred yards from the general shore-line at this point.

In most parts of the lake weeds reaching from the bottom to the surface of the water extend from shore to a depth of a little more than 6 feet. They are, however, absent where the shores are steep. In such places rushes and low vegetation, reaching only a few inches from the bottom, bridge the gap between the shore and the commencement of the larger weeds.

Close to the two islands which lie in the channel connecting the north and south basins of the lake there is a small depression a few feet across, reaching a maximum depth of 12 feet. In this depression there is a hot spring. The highest temperature recorded here was 95° Fahr. It appears, however, that the flow of water from the spring must be extremely small, for at a distance of a foot from the bottom the temperature was only 72° Fahr., the general temperature of the lake at the time being 60° Fahr. This spring can, therefore, have no sensible effect on the general temperature of the lake. The water in the neighbourhood of the spring gives off a strong smell of sulphuretted hydrogen.

The sounding of Lake Whangape was undertaken in order to ascertain whether it presented sufficient difference from Lake Waikare to justify a separate biological examination. Though the lakes differ greatly in outline, in almost all other features they are in close agreement.

Whangape lies to the north-west side of the plain through which

the Waikato runs. It has an area of 4 square miles. Its extreme length, measured on a straight line running roughly north-east and south-west, is $5\frac{1}{4}$ miles. Its greatest breadth, measured at right angles to the long axis, is a little more than 2 miles. A narrow channel, a quarter of a mile broad, divides a larger north from a smaller south basin.

The form of the lake-floor agrees closely with that of Waikare, the greater part of the area being included within the 8-feet contour. The maximum depth is the same as that of Waikare, namely, 9 feet. The deeper water of the north and south basins is separated by a stretch of shallower water at a point where the lake is narrowest. There are three islands in Whangape, two lying in extensions of shallow water running out from the shore, while the third is surrounded by water 8 feet deep.

The shores of Whangape are, in general, steeper than those of Waikare, since the former lies in more undulating land than the latter. In places, however, the shores of Whangape also are marshy and ill defined.

The number of soundings made in Waikare was 212, or 19·8 to the square mile; in Whangape 380, or 95 to the square mile. The work on the two lakes occupied from April 5 to 28, 1902. The sounding on Waikare was done from a small boat rowed by a Maori, that on Whangape from a stern-wheel steamer.

The outline, on which the soundings were plotted, was taken from a lithograph on the scale of 1 mile to the inch.

Roto Aira.

One small lake was sounded of which it is impossible to give any chart, since there is no existing plan of it in which the outline is shown with sufficient accuracy to be of any value. This is Roto Aira, a small lake of about 5 miles in area, situated 8 miles to the south of Lake Taupo, in the saddle between Tongariro and Pihanga. The water which leaves it enters Lake Taupo by the Waikato river.

Eighty-three soundings were made in the lake, the deepest water found being 48 feet, which occurred about the middle of the north-east side of the lake, rather less than half a mile from shore. The eleven lines of soundings which were made showed in almost every case a very rapid fall of the bottom from shore to a depth of between 30 and 40 feet, and after this depth was reached an almost level bottom. Shallower water was only found in the extreme north and south ends of the lake, in the neighbourhood of marshy shores.

Lake Wakatipu.

In a paper on the "Reconnaissance Survey of the Lake Districts of Otago and Southland,"* James McKerrow, district surveyor of the province of Otago, speaks in 1864 of some soundings having been made in Lake Wakatipu, near Queenstown, a depth of 200 fathoms being found. In the same year a map of the north-west district of Otago, showing six soundings in Lake Wakatipu, was made by Dr. Hector, and placed in the Otago museum. To these soundings Dr. Hector refers in a paper on "Mining in New Zealand,"† published in 1869. Speaking of the lake, he says, "It has been found by soundings to vary from 1170 to 1296 feet, the bottom being nearly level from side to side and from end to end." In 1870, in a paper on the "Physical Geography of the Lake Districts of Otago,"‡ McKerrow speaks in detail of Dr. Hector's soundings, and also mentions others having "been taken by several persons independently," the greatest depth given being "1400 feet about the middle of the lake off Collins bay, and 16 miles from the south end of the lake." Hutton also quotes the maximum depth as 1400 feet in a paper "On the Formation of Lake Wakatipu,"§ giving McKerrow as his authority; and, again, he quotes the same depth in his 'Geology of Otago.'‖

The measurements of Lake Wakatipu given in this paper are taken from a plan, on the scale of 1 mile to the inch, compiled by the Department of Lands and Survey at Dunedin, and supplied for the purpose of plotting the soundings taken. On this plan the positions of all trigonometrical stations close to the lake were shown; and, owing to the want of natural headlands or other marks on the shore, these stations were used in fixing the positions of soundings. The method employed was to place flags on the trigonometrical stations, and to run lines of soundings between pairs of flags on opposite shores of the lake.

The work done on Lake Wakatipu in 1902 occupied from October 1 to November 7. During this time 194 soundings were made, and these are shown in the plan which accompanies this paper. All sounding and dredging was carried out from the steamboats *Antrim* and *Ben Lomond*, which were formerly owned by the Lake Wakatipu Shipping Company, but were transferred, while the work was in progress, to the New Zealand Government Railways.

Lake Wakatipu extends from 44° 50′ to 45° 20′ S. lat., and from 168° 20′ to 168° 43′ E. long. The two ends of the lake lie in a direction almost north and south; the middle part is, however, deflected, so as to run nearly east and west. The extreme length, measured along a line running from end to end of the lake, and roughly midway between the two shores, is 49 miles. Throughout this length

* *Journ. R.G.S.*, vol. xxxiv. p. 56. † *Trans. N.Z. Inst.*, vol. ii., 1869.
‡ *Ibid.*, vol. iii. p. 254. § *Ibid.*, vol. v. p. 394. ‖ Dunedin, 1875.

the breadth is uniform, and the outline regular, except where the Frankton arm, a narrow extension of the lake $3\frac{3}{4}$ miles in length, projects in an easterly direction. Otherwise the extreme regularity of the breadth is indicated by the fact that, while the mean breadth is 2·3 miles, the greatest breadth is no more than 3·3 miles. The few bays which occur in various parts of the lake, such, for example, as Bob's cove, Beach bay, and Wilson's bay in the middle arm, and Collins bay, Drift bay, and Halfway bay in the Kingston arm, are of no great size; none of them project so much as a mile beyond the general coast-line.

The lake covers an area of 112·3 square miles, exclusive of islands, a small group of which, lying near the north end or head of the lake, has a total area of 1·25 square mile.

The surface of the water lies at a height of 1016 feet above sea-level,* the mountains which immediately border the lake having their highest points between 5000 and 8000 feet above the sea. The slope from the shores to the mountain peaks is abrupt, a height of 5000 or 6000 feet above the lake being often reached in a horizontal distance of 2 or 3 miles.

The catchment area of the lake amounts to a total of 1130 square miles. This area is bounded by well-defined ranges of hills, which are so disposed that the lake receives the bulk of its water from the north and west sides. The Richardson mountains (7432 feet), the Remarkables (7688 feet) (cf. Fig. 7), and the Hector mountains (7650 feet) lie indeed so close to the east shore that they contribute only small mountain streams. From the north, on the other hand, there come the two rivers, Rees and Dart, draining the more distant Forbes mountains (8159 feet), the Barrier range (7750 feet), and Mount Earnslaw (9200 feet). Similarly, on the west side the Ailsa mountains (8102 feet), the Thomson mountains (6306 feet), and the Eyre range (6530 feet) lie at a considerable distance from the lake-shores, and contribute respectively the Greenstone, the Von, and the Lochy rivers. At the south end of the lake the hills fall back and give way to a plain, which slopes away towards the south, and sends no streams into the lake. The outlet of the lake is by the Kawarau river, which flows out by the Frankton arm, and ultimately joins the Clutha river.

The shores of Lake Wakatipu are either steep slopes of broken rock, or beaches formed of coarse sand and pebbles. In the former case the slope of the shore is continued unbroken below the water-line, whereas in the latter case a shallow terrace usually runs out for a chain or more into the lake; beyond this terrace the bottom falls suddenly away into deep water. Such shores as these afford no foothold for vegetation, so that reeds or rushes nowhere fringe the shore. All vegetation which

* The height above sea-level is given in many maps as 1069 feet. This cannot be so, since one of the trigonometrical stations on the shore lies at 1042 feet. On the authority of the chief surveyor of Dunedin, I take the approximate height as 1016 feet.

FIG. 7.—THE REMARKABLES, LAKE WAKATIPU. IN THE FOREGROUND IS SEEN THE FRANKTON ARM.

does occur is found entirely submerged, and for the most part at a depth beyond the reach of violent wave-action. On the shallow terraces, however, there is often a growth of short submerged weed, which neither reaches to the extreme margin of the water nor extends more than about a fathom below the surface.

The basin of Lake Wakatipu agrees with other features of the lake in showing a remarkable regularity. From the north end or head of the lake, the bottom shows an unbroken fall, rapid at first, but constantly decreasing, for a distance of 32 miles. For the next 9 miles beyond there is a level floor, forming the lowest depression in the basin: thirteen soundings were taken within this depression, and the extreme variation of level recorded was 6 feet. The greatest depth found was 1242 feet. From the southern end of the level depression the upward slope of the floor commences, and a fairly uniform rise over a distance of 8 miles leads up to the shore at Kingston, the southern end of the lake.

The maximum depth of 1242 feet, which was obtained in 1902, does not agree with those depths which have been previously obtained. As has been stated above, in the account of previous soundings taken in the lake, depths of 1296 feet and 1400 feet are recorded. The latter depth, in particular, is said to have been found about the middle of the lake off Collins bay, and 16 miles from the south end of the lake. At the time when soundings were being made in 1902, the general belief among the inhabitants of Queenstown was that the deepest water was to be found off Collins bay, and for this reason a line of soundings was taken at that point, one sounding being placed midway across the lake, at a distance of between 15 and 16 miles from the south end of the lake; but no evidence was found of water of a greater depth there than elsewhere.

Contour-lines have been drawn in the plan, which accompanies this paper, at intervals of 200 feet of depth within the lake-basin. An examination of these contours will serve to illustrate the gradients of the lake-floor from end to end, and for this purpose the distances between successive contours, from the head of the lake to the south end, are given below in tabular form:—

North slope	Shore to	200-feet contour	0·3 miles.
	200-feet contour to	400 "	0·5 "
	400 " "	600 "	2·7 "
	600 " "	800 "	5·3 "
	800 " "	1000 "	6·3 "
	1000 " "	1200 "	9·7 "
Level depression	1200 " "	1200 "	17·4 "
South slope	1200 " "	1000 "	1·3 "
	1000 " "	800 "	1·0 "
	800 " "	600 "	1·7 "
	600 " "	400 "	1·3 "
	400 " "	200 "	1·0 "
	200 " "	shore "	0·5 "

From this table the regularly decreasing gradient of the north slope, the long level depression, and the fairly constant gradient of the rapid south slope can be clearly seen.

In McKerrow's paper,* the data of which are taken from Dr. Hector's soundings, with the depth of 1400 feet interpolated from another source, the sudden fall to 1400 feet is made to cause a break in the regular decrease of gradient in the northern slope, which break does not occur, as far as appears from the soundings made in 1902. To make this point clear, a parallel table is given below showing the gradients as determined from the two sources :—

	As given by McKerrow.	As determined in 1902.
Fall in first 2 miles ...	180 feet per mile	250 feet per mile.
„ next 4 „ ...	70 „	50 „
„ „ 5 „ ...	50 „	32 „
„ „ 7 „ ...	40 „	31 „
„ „ 6 „ ...	6 „	18
„ „ 6 „ ...	14 „	6
„ „ 3 „ ...	30 „	5
Rise „ 7 „ ...	6 „	level
„ „ 9 „ ...	96 „	136 „

From this table it appears that, according to the figures given by McKerrow, the north gradient, which has been steadily decreasing to a distance of 24 miles from the head of the lake, begins to increase at this point, and continues to increase for the next 9 miles, when the deepest water is reached; whereas the more recent figures show no break in the decrease of gradient until the level depression is reached.

Transverse sections taken at almost any part of the lake resemble one another to a remarkable degree. They show steep slopes leading down from opposite shores to a wide level floor, of a width equal to or rather greater than half the width of the lake at surface level. This characteristic trough-like formation is most marked where the depth is considerable. Within the 800-feet, the 1000-feet, and the 1200-feet contours, for example, the level floor at some points occupies as much as 50 per cent., 60 per cent., and 70 per cent. of the surface width. And even in shallower water a similar formation is evident, though to a less extreme degree.

There is but little special description needed to modify the general scheme of the lake-basin which has been already laid down, for the regularity of the basin is disturbed in but few places. The two larger islands, Pigeon island and Pig island, which lie in the north arm, are connected by a shallow bank, while the smaller Tree island, which lies to the west of them, is separated from them by water of greater depth, probably exceeding 200 feet. The whole group lies within a projecting arm of the 400-feet contour, which runs in a southward

* *Trans. N.Z. Inst.*, vol. iii. p. 254.

direction from the eastern shore. The channel between the eastern shore and the islands exceeds 400 feet in depth, except in its most northern part, while between the islands and the western shore there is a continuous channel over 600 feet in depth.

The Frankton arm barely passes a depth of 100 feet at any point, and is separated from the body of the lake by a barrier over which there is little more than 60 feet of water. Queenstown bay is also shallow, and its mouth is also crossed by a barrier. The other more open bays which the lake contains showed, as far as special soundings were made in them, a regular deflection of the contours, which calls for no special mention.

The volume of water in Lake Wakatipu, as calculated from the areas included between successive isobathic contours, is 15 cubic miles, and the mean depth is 707 feet.

Lake Manapouri.

The work carried out on Lake Manapouri occupied from November 10 to December 13, 1902. Much of this time was spent in throwing a triangulation over the main body of the lake, with a view to the more accurate fixing of the soundings. There had been previously only two trigonometrical stations placed on the immediate shore of Lake Manapouri, namely, those on Leaning peak and View hill, at the west and east ends of the lake respectively. It appears from a paper by McKerrow, "On the Reconnaissance Survey of the Lake Districts of Otago and Southland,"* that other points had undoubtedly been observed. McKerrow speaks in that paper of the inaccessible nature of the mountains, and the fact that the shore-line was shaded over with foliage, having rendered a vertical triangulation with magnetic bearings necessary. But these early observations had, of course, left no traces on the ground; nor was it possible to distinguish from the plan provided by the Department of Lands and Survey at Invercargill whether any particular point on the shore had been sketched or observed. Under these circumstances it was possible that the soundings might be fixed by relation to points which did not pretend to accuracy, and so might prove useless.

Accordingly a triangulation was thrown over the main body of the lake, based upon the trigonometrical stations† which lay nearest to the east shore. A plan showing the bearings of these stations was provided by the Survey Office of Invercargill. The triangulation included forty-one points on the lake-shore, and almost all of these were used as the extreme points of lines of soundings.

It will be seen from the plan which accompanies this paper, that the triangulation was not carried beyond the mouths of the various

* *Journal R.G.S.*, vol. xxxiv. p. 81. † View hill, Freestone hill, and "a."

arms or fiords which project from the body of the lake. Within these arms the broad features of the shore-line have been taken from the plans provided, while the details have been altered in such a way as to show clearly any minor features which may serve to identify the points between which lines of soundings were taken. The justification of such alterations, made without fresh trigonometrical data, lies in the greater certainty with which the lines of soundings may be re-plotted, if at any time the lake shall be more accurately mapped.

All angular measurements were made with a 5-inch transit theodolite. The points observed are shown in the plan as single circles; no cairn or other permanent record of these stations was left on the ground. The thick clothing of bush, which covers the country to the very water's edge, made it necessary to complicate the triangulation to some extent in order to avoid making large clearings near the water-line. In many cases this difficulty was overcome by using as observing stations small outlying rocks and islands too small to carry a dense covering of bush.

During the whole survey, including both the sounding and the triangulation, the steam-launch *Titiroa*, owned by Mr. Dore, of Manapouri, was used. A great debt of gratitude is owing to Mr. Dore for the constant active assistance which he gave to the work.

Lake Manapouri extends from 45° 27′ to 45° 35′ S. lat., and from 167° 28′ to 167° 40′ E. long. The main body of the lake runs in a direction almost east and west for a length of about 12 miles, divided by the large island of Pomona into an eastern and a western part. The latter gives off three arms or fiords, the north arm, the west arm, and the south arm, all narrow, and recalling in shape the sounds of the west coast, from which they are separated at the nearest point by barely 7 miles of land. To the east of Pomona the form of the lake is widely different. Three arms—namely, Shallow bay, Manapouri arm, and Hope arm—project from this part of the lake, but their outline is more rounded and less regular than that of the western arms. Moreover, the eastern end is closely studded with islands, one group of which, the Channel islands, forms a barrier extending across the lake from north to south.

The surface of the lake covers an area of 56 square miles inclusive of islands, which amount to 1½ square mile. The extreme length, measured on a curved axis running between the township of Manapouri and the head of the west arm, is 36 miles. The whole outline of the lake is so complicated that any attempt to convey an idea of its form by measurement must prove futile.*

The surface of the water lies at approximately 597 feet above sea-level, and the surrounding mountains rise on three sides to heights of

* Cf. 'Forel Handbuch der Seenkunde,' p. 39.

FIG. 8.—WALTER PEAK, AND PART OF CECIL PEAK (ON THE EXTREME LEFT), SEEN FROM QUEENSTOWN BAY, LAKE WAKATIPU.

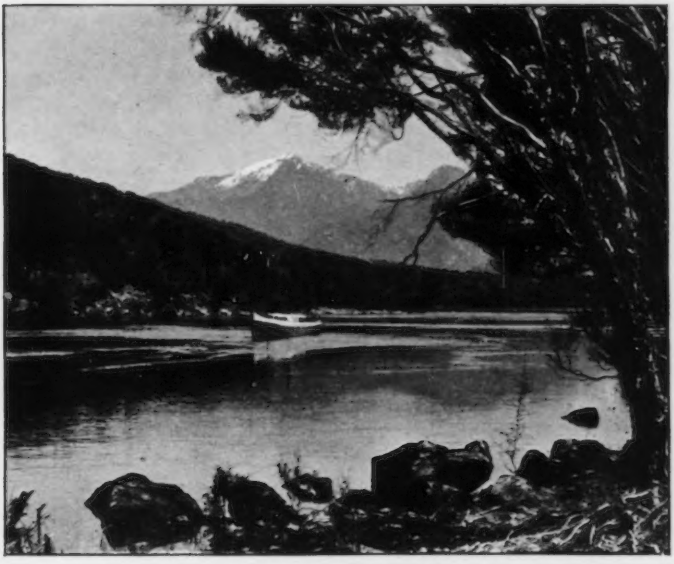

FIG. 9.—RIVER WAIAU, AT THE OUTLET OF LAKE MANAPOURI. THE HUNTER MOUNTAINS ARE SEEN IN THE BACKGROUND.

4000 and 5000 feet. These heights are, indeed, less than those of the mountains which rise from the shores of Lake Wakatipu, but the gradient from the water's edge to the mountain summits is more abrupt in the case of Manapouri, where heights of 4000 and 4500 feet above the level of the lake are reached in horizontal distances as small as a mile and $1\frac{3}{4}$ mile respectively from the shore.

On the north side of Lake Manapouri the catchment area is limited by the Kepler mountains, which contribute three considerable streams, the Iris burn, the Freeman burn, and the Awe burn. The west end receives the Spey river, draining the Matterhorn mountains which divide the lake from the west coast sounds. From the south comes a larger river than these, the Grebe river, which drains the Heath and Hunter mountains (cf. Fig. 9). The area drained by these rivers, which come directly into Manapouri, amounts to 460 square miles.

On the east side of the lake there lies a stretch of flat land extending for several miles from the lake-shore at an elevation of about 100 feet above the surface of the water. No streams of any size drain from this plain into the lake, but through it there passes the Waiau river, bringing into Manapouri the whole of the outflow from Lake Te Anau. With the addition of the area of 1340 square miles drained in this way by the Waiau river, the total catchment area of Manapouri amounts to 1800 square miles. The outflow from the lake is by a continuation of the Waiau river, which leaves in a south-easterly direction at a point close to the township of Manapouri.

The shores at the western end of Lake Manapouri resemble those of Lake Wakatipu in the alternation of almost perpendicular slopes with beaches of coarse sand and stones. Towards the east end, however, the beaches become far more prevalent, and in some places, where there is a considerable extent of shallow water, the shore is fringed with grass and reeds. In every part of the shores, excepting a small part near the township, dense bush extends from the hills to the waterline, and in many places even overhangs the water. In this point Manapouri offers a remarkable contrast to Wakatipu, from whose shores bush is absent, excepting some small remnants which survive in the more sheltered valleys.

The greatest depth found in Manapouri was 1458 feet. This depth occurs within a large depression, 2·7 square miles in area, all of which exceeds 1400 feet in depth. It is well to note that the deepest depression in this lake is surrounded by the highest and the steepest slopes which the shores afford. The mean gradient from the shore to the nearest summit is on the north side approximately 1 in 2 until a height of 4531 feet above the lake is reached, and on the south side 1 in 1·5 up to a height of 4272 feet above the lake. The 1400-feet depression sends out two considerable tongues, one into the south arm, and the other eastward between Pomona island and Cone peak. The depression

included within the 1200-feet contour follows a similar though far more extensive course. Failing to enter the passage which reaches westwards towards the west and north arm, it sends a tongue fully halfway up the south arm, and another eastwards beyond the more northern of the Channel islands. There is a remarkable widening of this depression where it passes to the south-east of Pomona; having been narrowed to a bare quarter of a mile in the straits between Pomona and Cone peak, it expands until it reaches a width of almost a mile at its widest part. Finally, it narrows again to pass between the Channel islands.

The 1000-feet depression is interesting, because, unlike those which lie below it, it runs deep into the north arm, and closely skirts the entrance of the west arm. Elsewhere it follows the deeper depressions, running southwards within 2 miles of the head of the south arm, and eastwards between the Channel islands to the mouth of the Manapouri arm. It includes an area of 10 square miles.

The remaining contours take for the most part an even course between the 1000-feet depression and the shore, except where they are deflected by the many islands which the lake contains. Thirty-three of these islands are shown in the accompanying plan, and there are many more of smaller size. To these islands the lake owes much of the character of its scenery (cf. Fig. 10), as well as the configuration of its basin. None of the islands are surrounded by water of a depth exceeding 600 feet. Pomona (cf. Fig. 11), the largest, whose area is a little more than a square mile, is connected to the north shore by a bank covered by 200 feet of water at its narrowest part, so that all the contours, excepting the 200-feet line, are deflected to the south of the island. Rona island, the next in size, lies between the 200-feet and 400-feet lines, causing considerable outward deflection of the latter.

The Channel islands appear on the surface to form a continuous chain stretching right across the lake. In reality they are divided into three groups, a north, a south, and an intermediate. The north group, consisting of two islands, or rather of an island and a rock, is connected to the Beehive by a channel only 150 feet in depth. The south group, in which eleven islands are included, also lies within the 200-feet contour, being connected to a headland of the south shore by a channel 170 feet in depth. The intermediate group contains six islands. It is separated from the south group by a channel about 500 feet deep, while between it and the north group there lies water of a depth exceeding 1200 feet. This group of islands deflects all the contours on its west side in a remarkable way. It appears to have a long western slope, extending for three-quarters of a mile under water before a depth of 400 feet is attained.

All the islands which have not been already mentioned lie between the 200-feet contour and the shore.

Of the three large arms which the west end of the lake gives off,

FIG. 10.—LAKE MANAPOURI, LOOKING WEST BETWEEN THE CHANNEL ISLANDS.

FIG. 11.—LAKE MANAPOURI, LOOKING NORTH-WEST FROM THE MOUTH OF HOPE ARM. POMONA ISLAND IS SEEN ON THE LEFT, AND BEYOND IT LIE THE CATHEDRAL PEAKS.

the larger south arm contains the deepest water. Next in depth is the north arm, sloping quite as rapidly as the south arm, and only lagging behind in depth because its length is less. The west arm is the shallowest of the three, and its gradient is the least steep.

The arms of the eastern end are far shallower than those of the west end. Hope arm and Manapouri arm closely resemble one another in depth, each admitting the 600-feet depression. Shallow bay admits the 400-feet depression, but a depth of 600 feet does not occur near its mouth. The smaller bays of the eastern end, such as Circle cove and Calm bay, are shallow, not reaching a depth of 200 feet.

Conclusion.

It is difficult to make general statements which will sum up any points in the morphology of the lakes which have been described. This difficulty arises in the main from the strange heterogeneity of the lake-basins. It would be hard, for example, to find any points of resemblance between two lakes such as Taupo and Wakatipu. In the latter the lake-basin seems to be an integral part of the surrounding country; its slopes continue the slopes of the mountain-sides. It is a mountain valley filled with water, and if it were drained dry it would scarcely appear in any way remarkable. Contrast with this the basin of Taupo. It is a trough abruptly sunk in a country which seems wholly unprepared to receive it. The perpendicular cliffs which form its western shore drop suddenly down from among hills whose slopes are comparatively gentle; in one place the cliff even forms a clean section through a large hill, cutting it from base to summit with a perpendicular face over 1000 feet in height.

In their relations to the surrounding country, Manapouri may be classed with Wakatipu, and Rotoiti with Taupo. In the former group there is a correspondence between the position of the deepest water and the gradient of the land in the immediate neighbourhood; in the latter group no such relation can be traced. In Wakatipu the greatest heights combined with the steepest gradients are those of the Remarkables (cf. Fig. 7) and Cecil peak, and between these the deepest water lies. In Manapouri the same conditions are fulfilled by the Cathedral peaks (cf. Fig. 11) and Cone peak. The existence of this relation indicates a rough correspondence in type between these two southern lakes and such familiar types as the lakes of the English Lake District.

A further point of similarity between Wakatipu and Manapouri is the presence in each of a large flat area where the water is deepest. This peculiarity of form is not to be confused with the tank-like form of Taupo. In the former, sloping sides lead down to a level floor, which marks the limit of depth; in the latter, perpendicular sides lead to a level floor, beyond which there is a further slope to the deepest point.

In Lake Taupo, the steepest gradient leading to the highest point is found at Karangahape, on the western shore, but the deepest water lies in the north-east part of the lake. In Rotoiti there is a similar lack of correspondence between Matawhaura, at the east end of the lake, and the deep water which lies some distance to the west of it.

The two lakes Taupo and Rotoiti have in common a tank-like form of basin. It is also possible that a relation between the two may be indicated by the presence in each of isolated banks or shoals. Examples of such shoals are found in the west end of Rotoiti, and in Taupo between Karangahape and the island Motutaiko.

The remaining lakes form a very heterogeneous lot. Rotorua is a saucer-like depression, a mere continuation of the whole catchment basin in which it lies, regular in its outline and in its subaqueous slopes. It cannot be compared to the more abrupt and tank-like lakes among which it lies, though it may possibly have with them a common origin in subsidence, similar but less violent.

Waikaremoana presents features which connect it with the valley lakes. It may be considered as a system of radiating valleys, having its deepest depression at the point where all the valleys meet. It differs, however, from the southern lakes in the more blunt and open form of its valleys, and in the fact that sections of its basin show an outline resembling rather the letter V than the letter U.

Waikare and Whangape are so shallow as to rank rather with swamps than with lakes, in spite of their considerable area. The interest of the former lies chiefly in its peculiar relation to the Waikato river, a relation which enables it to reduce the harmful effects of floods, though not lying on the river's actual course.

THE WALDSEEMÜLLER FACSIMILES.*

By EDWARD HEAWOOD, M.A.

The promised facsimiles of the Waldseemüller maps, discovered in 1901 by Prof. Fischer at the castle at Wolfegg, have at last been published, and in a style which is fully worthy of the importance of the subject; both the actual reproduction of the maps and the general get-up of the volume being a credit to all concerned. The excellence of the result is due, in part, to a grant from the Imperial Academy of Sciences at Vienna, which has made it possible to do justice to the subject without unduly increasing the cost. The matter supplied by

* 'The oldest map with the name America of the year 1507, and the Carta Marina of the year 1516, by M. Waldseemüller (Ilacomylus).' Edited by Prof. Jos. Fischer and Prof. Fr. v. Wieser. Innsbruck: Wagner. London: Henry Stevens, Son and Styles. 1903.

the maps is so extensive, that it will be long before the subject is exhausted as a field for study. All that can be done at present is to put before the reader the results of a preliminary examination.

The main facts of the history of the maps and the lessons to be learnt from them are outlined in an introduction by Profs. Fischer and Wieser, who, since the discovery of the maps by the former, have been at great pains to elucidate the questions suggested by them, through a comparative study of the literature and cartographic documents of the period. The general conclusions arrived at will meet with ready acceptance, although on occasional points of detail it may be permissible to differ. It may be regretted that the space allotted to this introduction hardly admits of an exhaustive treatment of the subject, a certain restraint and compression of style being frequently apparent, while lines of inquiry are now and again suggested without being pursued to a definite end. A more exhaustive presentment would no doubt have unduly delayed publication, and students will be grateful that the maps have been made available with as little delay as has occurred. The text is printed both in German and English, but the translation is not quite a success, German idiomatic phrases being too often literally reproduced.

For an outline of our previous knowledge of Waldseemüller and his work, and of the circumstances attending the discovery of the maps, reference may be made to Mr. Soulsby's article in the *Journal* for February, 1902, attention being at present given to the maps themselves, their sources, and influence on subsequent cartography. As mentioned in that article, each of the maps (the World-map of 1507 and the Carta Marina of 1516) consists of twelve woodcut sheets, capable of being fitted together to form a large wall-map, and with an artistic border round the outer margin. The whole twenty-four were bound together in a folio volume, which had been the property of the well-known map-maker Johann Schöner, as shown both by his book-plate inserted inside the cover and by the fact that strips of parchment, cut from prints of his terrestrial and celestial globes of 1515 and 1517, had been used in the binding. The volume contained, besides, the 1515 star-map of Stabius-Heinfogel, drawn by A. Dürer, as well as gores of the celestial globe just mentioned. On various sheets of both maps manuscript corrections and additions have been made, while a list of *errata*, originally engraved on a sheet of the Carta Marina, has been covered with a pasted slip, the corrections having been made in their proper places. In the case of one sheet—that including West Africa—the *errata* were apparently so numerous that it was necessary to re-write the legends on a manuscript copy,* which

* The facsimile reproduction of this sheet measures appreciably less than the corresponding engraved sheet, but this may either be due to a shrinking of the original paper, or to a slight error in the reproduction.

has been bound up with the rest, while the original sheet—the only one left in its uncorrected state—was inserted loosely in the volume. The conclusion is drawn by the editors that the sheets which have come down to us were "proof-sheets," by which must be understood copies revised in preparation for a new edition, not "pulls" taken before the first issue of the maps. In support of their character as proofs, it is stated that the print *overlies* the network of single degrees drawn in red upon the sheets, though it is hard to believe that—were this network drawn *before* the print was made—we should find such accurate "register" as we do;* while the motive for drawing such network is left unintelligible. Is it not possible that the network and marginal degree-notation (also inserted by hand) were put in by Schöner for his own map-making purposes, for which we know that both maps were certainly utilized?

The Carta Marina is definitely signed by Waldseemüller, while the earlier map is without any statement either of date or authorship. But the evidence, both internal and external, in favour of its being the long-lost map issued with the 'Cosmographiæ Introductio' is so strong as practically to lead to certainty. We may dispense with a detailed presentment of the argument, supplied in full by the editors, the main points consisting in the entire agreement with the statements in the treatise, both as regards the map in itself and the points in which it differed from the globe issued in the same year,† and the general resemblance with the Carta Marina in size, plan, and execution.‡ Both maps, especially the later one, are fine specimens of wood-engraving, and the blocks were probably prepared at Strassburg (not St. Dié), then a well-known centre of the wood-engraver's art. This is also indicated by the water-mark of the 1507 map.

To come now to the maps themselves. That of 1507 is a general map of the world, surrounded by an ornamental border with spirited

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* On the map of 1507 every tenth degree-line has been engraved, while the network of single degrees has been inserted, in certain parts of the map, by the separate subdivision into tenths of each larger space. In the Carta Marina, on which no net was engraved, the subdivision has evidently been made by stepping the degree-spaces, beginning from one margin, with the result that a small space is sometimes left over at the other end.

† Known to us, as has been demonstrated by Prof. Gallois, through the gores in the collection of the Prince of Liechtenstein, a new reproduction of which is given in the text. The idea which has been put forward, that the insets in the large map form the representation *in solido*, cannot certainly be accepted.

‡ In reference to the much-quoted statement of Trithemius, as to the globe and map purchased by him in 1507, the editors make out a more satisfactory agreement than is quite justifiable. Trithemius says that the map extended south almost to the tenth parallel, meaning, no doubt, the tenth 5-degree line, or 50°. The 1507 map ceases at 40°, except where it is prolonged to include South Africa, while the parallels are drawn at intervals of 10°, and only in a few instances are the spaces bisected in the margin.

representations of the winds, imaginary portraits of Ptolemy and Vespucci, and two small insets which are noteworthy as the first instances of a division of the world into two hemispheres, each on its own projection. They have long been known, though not as by Waldseemüller, from the close copies brought out by Stobnicza, and several times reproduced within recent years.* The main map, as might have been suspected from the copies of it by later hands (Glareanus, 1510; Apianus, 1520, etc.), is on the second of Ptolemy's projections, used for the Ptolemaic world-maps of Donnus Nicolaus, but now for the first time extended in longitude so as to embrace the whole circumference of the globe. There is a slight difference between the large map and the insets (of which, however, the editors say nothing), in that in the former the meridians make an angle at the equator, while they form continuous curves on the insets. This may be the result of faulty construction, which would not be surprising in view of the difficulties caused by the division of the map into so many sheets. Its immediate cause is apparently the somewhat excessive lengths of the degrees of longitude on the equator as compared with those of latitude on the mean meridian, and the fact that south of the equator the degrees of latitude are somewhat too short.†

As had been known from passages in the 'Cosmographiæ Introductio,' the map is a compromise between the Ptolemaic tradition, by which Waldseemüller was still to a great extent bound, and the newer knowledge embodied in the Portuguese nautical charts. For a large part of the old world the delineation closely follows that of the Ulm maps of 1482 and 1486, even to the precise trend of the mountain ranges. For the eastward extension beyond the limits of the Ulm maps the sources are somewhat more obscure, though maps identical in all the main particulars have long been known, including Behaim's and the Laon globes, the map of Martellus Germanus (about 1489), and the Portuguese map in the possession of Dr. Hamy. The editors incline to the opinion that a chart of the Hamy type has exercised a preponderating influence, for it too combines the new discoveries with a representation of Eastern Asia similar to Waldseemüller's. Certain facts, however, not referred to by the editors, would seem to point rather to a map of the Martellus type as one of the main sources drawn upon. In this map, too, we find an exact copy of the Asiatic features of the Ulm maps (not inserted in the Hamy map), combined with a similar extension towards the east and

* While Stobnicza was content merely to copy these insets, Glareanus, in the small manuscript maps lately brought to light, took the trouble to make a reduction of the large map.

† The projection differs from the heart-shaped projection of Werner in that the centre of the concentric circles of latitude is not at the north pole, but a little over 181° from the equator. It was to a certain extent modified by Glareanus, but closely adhered to by Apianus and others.

south-east, while certain features of the 1507 map are found in Martellus alone, of the sources mentioned. Among these are the delineation of the north coast of Asia, with the representation of forests at various parts; the location of the site of St. Thomas's death, and the position of the legend "Regnum Lac" on the supposed south-eastern peninsula; the term "Oceanus Indicus Meridionalis," applied to the Indian ocean (in distinction from the "Oc. Orientalis Ind." east of China); while on the west coast of Africa certain of Waldseemüller's legends, not occurring on the Hamy, Cantino or Canerio charts, are to be found on Martellus' roughly drawn world-map.* It need not be supposed that Waldseemüller necessarily copied direct from Martellus, but the facts quoted point, in harmony with the already expressed view of Mr. Ravenstein (*Journal*, vol. xx. p. 462), to the probable existence of some early source from which Martellus, Behaim, the maker of the Laon globe, and Waldseemüller alike drew. The point is of some interest by reason of the extraordinary vitality (due to its adoption by Waldseemüller) which characterized this particular delineation of South-Eastern Asia, both in respect of the large islands from Cipangu to Madagascar bearing names derived from Marco Polo, and of the great peninsula which is such a feature on maps of the period.† A further possible point of connection between Martellus and Waldseemüller is the fact (which we have not seen noticed) that, in spite of apparent difference of projection, the "Hydrographia sive Charta Marina" of the 1513 Ptolemy might almost, apart from a slight difference of scale, have been traced from that of Martellus in the parts relating to Europe, North Africa, and the whole of Northern and Eastern Asia.‡

* The fact that the Martellus map is without scale or degree net, and is, besides, very roughly drawn, makes it difficult to compare it effectively with other maps. The shape of the map border, combined with the similarity to the Ulm Ptolemy map, makes it fairly certain that it must have been based on a map drawn, like the latter, on Ptolemy's second projection. An attempt to reconstruct the degree net on this basis shows that while the co-ordinates in certain parts agree fairly well with Ptolemy's, in others there is a wide divergence. In regard to the whole south-western quarter, the data for which are evidently taken from portolani, it is impossible to suppose that such a degree net was used at all, these portions being apparently taken direct from some chart on a rectangular projection, and pieced on to the rest without due regard to orientation. In fact, the whole of this part seems to be drawn at an angle of some 6° with the major axis of the rest of the map, and this would account for the inclination of the axis of the Mediterranean, and with it of North Africa; the low latitude of the British Isles; and the inclination of the axis of the Red sea as compared with Ptolemaic maps.

† The fact that this peninsula is obtained directly from Ptolemy by breaking through his coast-line at the point where his positive data cease, renders it probable that the prototype of all these maps was drawn by a popularizer of Ptolemy, such as Donnus Nicolaus, whose delineation of inner Asia is, as we have seen, exactly copied both by Martellus and Waldseemüller.

‡ It is not absolutely certain that the 1513 map was by Waldseemüller, though its close agreement with the Carta Marina of 1516 hardly permits doubt of the fact.

For the whole of the newly discovered regions, the map which formed Waldseemüller's chief source was evidently of the Canerio type, if not the Canerio map itself.* This is shown by the entire agreement of the two in respect of the new world; by the adoption in the later map of many of the legends round the coasts, even where these themselves are shown differently, as in the case of South-East Asia; and by the placing of Portuguese flags in identical positions along the coasts. The point which gives the map its unique character in the eyes of Americanists is of course the fact, long suspected from previously known data, that the name America is on it (for the first time, so far as can be known with certainty †) applied to the western continent. The name is placed on South America just above the tropic, in by no means large characters, and this gives some support to the idea that the name was intended in the first instance to apply only to the southern part of the new world—the portion, in fact, with which Vespucci himself was acquainted. But too much stress must not be laid on this, for the parts of North America then known would be regarded rather as adjacent islands than as part of a continental mass (except by those who identified them with Asia), while the location of the name Parias, derived from Vespucci's alleged first voyage (erroneously spelt Lariab in the Italian version of the letters), on the northern portion of the new lands, shows that Vespucci's claim to have sailed along this northern coast was allowed by Waldseemüller. In discussing Glareanus' copies of the 1507 map, Prof. Elter called attention to the difference in colour there found between North and South America. But this is fully accounted for by the common practice of showing islands in a distinct colour from the adjacent mainland, while in other maps by Glareanus recently brought to light and described by the present writer at the Southport meeting of the British Association, the two portions of the new world are shown in precisely the same colour.

Owing to the adoption by Waldseemüller of Ptolemy's erroneously placed equator, the Rio Cananor, the furthest point named on the South American coast, is brought down beyond 40° S., while the Portuguese charts place it between 30° and 35°. The erroneous rendering "Abbatia (corruption of A baia) omnium sanctorum" appears on the map, as in the Latin version of the "letters," though the editors seem mistaken in attributing the mistake to Waldseemüller in the first

* The American portions of this map are shown in Kretschmer's atlas and in Marcel's collection. A drawing of the south-eastern part was given by Mr. Ravenstein in his "Vasco da Gama" (Hakluyt Society).

† It will be remembered that Mr. Henry Stevens regards a map lately found by him in a copy of the 1513 Ptolemy, which also bears the name America, as probably slightly earlier, but on this no opinion can be expressed until Mr. Stevens' case is stated more fully.

instance.* Undue importance seems also to be attached by them to certain differences between the large map and the inset in regard to the delineation of America. One consists in the showing of a strait between North and South America in the large map, while the inset shows the land as continuous. But the break in the land can hardly indicate any definite belief in a strait, as the coast-lines are merely copied from the Canerio chart, which marked only the parts supposed to have been visited; while on one of his maps Glareanus expressly states that the extent of the land in this region had not been ascertained. Another contrast is supposed to be seen in the representation of the west coast of South America, the angle of which is stated to be much more acute in the smaller map. This will be found to be due almost entirely to the projection, the curves of the meridians being in the opposite sense in the two maps. In both cases, moreover, the coast is avowedly shown as unknown, so that any difference would necessarily be devoid of meaning.

The mapping of the interior of Africa presents an interesting problem, though this is passed over very lightly by the editors. In spite of the evident guesswork on which it is based, this portion is of interest as representing the first origin of the attempted combination of Ptolemaic and recent *data* which was of such supreme influence on African cartography for the best part of two centuries. M. Wauters, in his ingenious paper on Lake Sachaf, has traced the fantastic representation of Central African geography, which culminated in Dapper's map of the seventeenth century, to a source early in the sixteenth, and has even—through an error, as it happens—correctly ascribed the original inspiration to Waldseemüller. The importance of the Ptolemaic tradition in the gradual evolution of the Dapper type of map is shown by the fact that it was precisely in the countries where that tradition held its ground longest that the fictitious representations of Central African geography were also most prevalent; and the discovery of Waldseemüller's two maps materially strengthens the evidence for this view. In the 1507 map, *e.g.*, it is evident at a glance that the representation of the Nile and its lakes is Ptolemaic pure and simple, but that place-names have been added from recent sources, though these are not so easy to identify. The map is practically the first in which the names properly belonging to Abyssinia and its vicinity are associated with the Ptolemaic lakes, for though we have a similar southward misplacement in Fra Mauro, this is due merely to an exaggeration of scale affecting the whole of North-East Africa, and

* The corruption is to be found in the map, closely resembling the Hamy chart reproduced by Kunstmann in his Atlas (No. 2), and of which a drawing is given by Kretschmer. The date of this can hardly be much later than 1502. But even in this case the error may have originated with Vespucci.

not to a conscious association of the names with more southern regions. Again, on Behaim's globe, the Ptolemaic basis is not so pronounced. The Carta Marina carries us one step further in the process of evolution, being much more filled up with detail, and approaching more closely the later representation of Mercator, Gastaldi, and the host of subsequent imitators.

The idea that Waldseemüller may have copied to some extent from Behaim receives no great support from an examination of the 1507 map, although certain resemblances in the nomenclature of inner Africa cannot be denied. As Mr. Ravenstein has already pointed out (*Journal*, vol. xx. p. 462), such resemblances are probably due to the fact that a common (though at present unknown) source has been drawn upon by the two map-makers, as well as by the engraver of the Laon globe. Among the names given by both Behaim and Waldseemüller, in more or less similar positions (Gafat, Zara, Dedel, Abia, Zema, Delsam, Gargisa, etc.), most are derived from names belonging properly to Abyssinia and neighbouring regions. The name Sacaff, destined to play so important a part in the fanciful geography of the next two centuries, appears for the first time, in 1507, as that of a lake in the far south-west, discharged by a river whose course recalls that of the Abai —the name Abia occurs near it—though not connected in any way with the Nile. All these names are scattered at haphazard over the map, which evinces far less accurate knowledge of the Abyssinian region than was displayed by Fra Mauro.

We must now pass to the Carta Marina, of which, though an equally remarkable specimen of cartography, there is perhaps less need to say much, seeing that it is, broadly speaking, merely a revised and augmented edition of the Canerio chart, with which it agrees in projection, delineation of the coast-lines, and area included; for, unlike the 1507 map, it omits the whole space between 152° and 280° east from the Canaries, or that intervening between the east of Asia and America.* As regards the outline, it is also in close agreement with the maps in the 1513 Ptolemy. Canerio's delineation of Southern Asia has now been adopted, the author having at last made up his mind to discard the Ptolemaic outlines, and the exaggerated easterly extension of Africa found in maps of the Canerio type, with the resulting displacement of the axis of the Red sea, has been closely copied.† The most remarkable characteristic of the map, and one in which its influence may have long been felt, is its indication that Waldseemüller had at this time reverted

* This was but natural in the Canerio chart, based on the nautical knowledge of the day.

† In spite of this, however, the extent in longitude of Southern Asia has been so much reduced that the "Sinus Magnus" falls to the west, not to the east, of Ptolemy's position, accepted in 1507. The editors' statement that the deviation from Ptolemy's longitudes is due to the eastward extension of Africa, is thus not entirely correct.

to the belief that the newly discovered western lands formed part of Asia, as is stated in the legend on the portion of North America shown, "Terra de Cuba Asiæ pars." * This is the more remarkable that, in the sketch-map in the 'Margarita Philosophica' of 1515, shown by Wieser to have been almost certainly the work of Waldseemüller,† the existence of an intervening ocean is expressly indicated, while the world-map in the 1513 Ptolemy seems to presuppose the same view, although by stopping short at a line through Cuba, it expresses no definite opinion on the subject. Contrary to what might be thought at first sight, the 1516 chart does not discard the great south-eastern peninsula of Asia, for the legend "Sinus magnus" to the east of the Malay peninsula, coupled with the fact that the peninsula is retained in the 1513 and 1515 maps, certainly implies that, had space allowed, Waldseemüller would still have adhered to his old drawing of this region. As regards the American portion, it is noteworthy that, though he gives the name Cuba to the land-mass west of the true Cuba, he still gives the outline of the latter (without a name) in its proper place. But instances of similar confusion are frequent about this time,‡ and all may be due to the omission of Cuba from its proper place by Ruysch. Waldseemüller's error was naturally propagated by his copyists (Schöner, 1520; Novus Orbis, 1532), among whom it seems we must number the maker of the "Nordenskiöld" gores, to which their owner assigned a date previous to 1516.§ But it is singular that the copyists, while taking this erroneous nomenclature from the 1516 map, still adhere to the general notions of that of 1507.

Another noteworthy difference between the maps of 1507 and 1516 is the omission of the name America from the latter, as from the 1513 Ptolemy, which, together with the more prominent mention of Columbus, favours the view that the cartographer was at this time anxious to repair the wrong done to the latter by his earlier suggestion. The name Parias has been transferred to the north of South America, while further south we find, as in the 1515 map, the name Prisilia, afterwards corrected to Brasilia. The 1516 map differs from those of 1513 and

* Ruysch had, of course, already accepted such a connection as regards the more northern part of America, while Glareanus (1510) and Bernardus Sylvanus (1511) had admitted its possibility.

† This sketch-map would seem to have been originally drawn to embrace the same proportion of the Earth's circumference as the Carta Marina, a vertical line cutting off the part omitted from the latter.

‡ Thus Stobnicza gives the name Isabella to the western land, leaving Cuba nameless. The Margarita map of 1515 names both Haiti and Cuba "Isabella," and the western land Zoana mela (probably a corruption of Joana insula, as shown by Wieser). In the Novus Orbis map of 1532 (Basel edition) only one island is shown, the name Spagnola being placed below it, and Isabella above.

§ It is curious that in certain details not taken from Waldseemüller, these gores are closely followed by Bordone in his very rough map of 1528.

1515 in still leaving open the strait between North and South America, owing probably to the closer adherence to the Canerio map. The most important difference from the latter consists (apart from such details as the different shape of Ceylon and Madagascar, and the substitution of "Samotra" for "Ataprobana") in the copious nomenclature of the interior of the continents, derived from various literary sources enumerated by the editors, but into which we cannot enter here.

There is one point not yet alluded to on which it would be interesting to have further light, viz. the representation of Java in quite a new position south of the Malay peninsula in the 1516 map. It does not appear whether this is original, or taken, like the rest, from the Canerio chart. Mr. Ravenstein's sketch of the latter leaves the question open, as the space is covered by an inset. In any case, it seems not impossible that Waldseemüller's delineation of Java as "Iava insula maxima," to the south of and much larger than Sumatra, may have supplied the inspiration to Desceliers and others of his school for the "Jave la Grande," which has given rise to so much speculation. The contour of the coast is not unlike that of the northern part of Jave la Grande, but a more striking fact is the occurrence, on Waldseemüller's Java, of a picture of cannibals, which has certainly, either directly or through copies, inspired the similar picture on the great Java of Desceliers' map of 1550.

The influence exercised by Waldseemüller on the map-making of his time is too obvious to require speaking of at length. Few maps have been so unblushingly pirated through so long a period as the 1507 world-map, while the influence of the Carta Marina, though not quite so obvious, is shown by the various maps in which its woodcuts have been reproduced, though often with reference to quite different parts of the world. This was due, no doubt, to the imposing style in which the maps were produced, and in the case of the earlier one, the large number of copies issued. It must be confessed that the influence was not entirely beneficial, as tending to stereotype the geographical conceptions of the time, and lessen the influence of the more accurate maps already beginning to appear. If the editors err at all, it is certainly not on the side of underrating Waldseemüller as a critical cartographer, for it cannot be denied that he sometimes shows a somewhat slavish adherence to his authority for the time being. Instances are to be found in his retention of the Ptolemaic representation of the British Isles in 1507; of a fifteenth-century representation of Eastern Asia in 1515–16; and of the Greenland of the Zamoiski-codex type so late as 1516, even when assigning to it the name "Terra Laboratoris." He was not always more happy when he struck out a line for himself, as in the mapping of the interior of Africa. His great merit was the remarkable enterprise shown in planning and executing works of such magnitude as the two printed maps now brought to light, which, from

the point of view of technique, marked an immense advance on all previous work of the kind. It must be remembered, also, that these world-maps are by no means the only important productions of the Alsatian cartographer, whose European maps are, in their way, no less noteworthy.

BARON TOLL.

By Prince KROPOTKIN.

THE Russian papers announce the return to St. Petersburg of the engineer M. I. Brusneff, one of the members of the expedition of Baron Toll who went with the party of Lieut. Kolchak in search of the head of the expedition in Bennett island. M. Brusneff had received from Baron Toll the order, in case the *Zarya* should not reach Bennett island, to come to meet him with a party. Accordingly he started, with five sledges and sixty dogs, from Ust-Yansk on February 24, 1903, for New Siberia. This would seem very late, but it appears that the hunters never start before April. M. Brusneff was accompanied by a sailor, Tolstoff, and five native hunters. On March 14, N.S., they reached the Great Lyakhoff island, and there divided into two parties. Tolstoff, with three hunters, went to Kotelnyi, while Brusneff, with the others, took the way of New Siberia, which they reached on March 24. Five days later M. Brusneff and his party started on for Bennett island, but they met an open sea, and were compelled to return. The end of March and April were given to the arrangement of stores of provisions. On May 3 Tolstoff joined Brusneff on New Siberia, after having searched the western and northern shore of Kotelnyi, as also the north-eastern shore of Thadéeff island. Both, having no means of crossing the sea, remained where they were, continuing to search along the nearest shores in the expectation of Baron Toll's appearance. On August 12 Lieut. Kolchak came to join them in a boat, and on August 15, after having taken some provisions from Brusneff, he sailed towards Bennett island with six men.

Although Bennett island, M. Brusneff writes, is 140 versts (93 Eng. miles) from New Siberia, Lieut. Kolchak succeeded in making the passage in two days, owing to the absence of ice and a good wind, instead of the twenty-two days which it took Baron Toll. He stayed only two days on Bennett island, and, having found the documents left there by Baron Toll [their translation is given further on], he returned. In two days he reached Cape Voznesenie, in New Siberia, and, following the coast for another three days, joined Brusneff, who was then 17 miles from Cape Visoki. On August 26 Lieut. Kolchak went to Kotelnyi.

On September 2 Brusneff left, with his dog-sledges, with the intention of making the round of the coasts of New Siberia. This was hard work, as the sledges had to be dragged over a snowless soil, and the party advanced only about 7 miles a day. With all that, Brusneff was the first who made the full circuit of New Siberia. No traces of Baron Toll were seen. This time was also given to collecting a supplly of reindeer-meat, and while they waited for the sea to be frozen, the party prepared warm clothing and boots, made out of reindeer-fur, for the return journey. As to the party (that of Lieut. Kolchak) on Kotelnyi, they had to feed for two months on white bears, which also appear in numbers on the eastern coast of New Siberia, but chiefly in September.

The Blagoveschensk strait, on the western coast of New Siberia, was frozen on December 1, and three days later M. Brusneff and his party began their return

journey. The ice was still very thin, and for 20 miles they had it only one inch thick, although the polar night had already begun. Next day, M. Brusneff was on Thadéeff island, where he found Tolstoff's party, and they immediately resumed the journey. On December 19 they were already at Kazachie, where Lieut. Kolchak had also arrived a few days before.

Brusneff brought back rich zoological, geological, and botanical collections, and made meteorological observations throughout. As to Lieut. Kolchak, having learned at Irkutsk that the war had begun, he left to join his post in the far East.

M. Brusneff is of the opinion that Baron Toll must have perished on his journey from Bennett island to New Siberia. He must have there met with an open sea which it was impossible to cross at such a dark and cold season of the year, on account of the "grease" (*salo*), or floating ice in formation on its surface. He had provisions for only a fortnight, and the party must have suffered severely from want of warm clothing. Having killed on Bennett island only six reindeer, they could not have prepared enough clothing for the four men. And they could not winter on Bennett island, as they had no provisions for that, and would have had no fuel.

Of the papers left by Baron Toll on Bennett island, and discovered by Lieut. Kolchak, the following is a translation of the more important, communicated by the Secretary of the Expedition Committee, V. L. Bianchi, to the Russian press:—

"In company with the astronomer, F. G. Seeberg, and two hunters, the Tungus Nicholas Diakonoff and the Yakut Vassili Gorokhoff, on June 7 * I left the winter harbour of the *Zarya* (Nerpichiya Bay of Kotelnyi island). We followed the northern coasts of Kotelnyi and Thadéeff islands, keeping our course towards Cape Visoki on New Siberia. On June 13 I took the course towards Bennett island. The ice was pretty broken. On June 25, three miles from Cape Visoki, the ice was definitely broken. Preparing to take to our *baidaras* [leather boats], we killed our last dogs. From here we were carried on an ice-floe, for four and a half days, 48 miles in the desired direction. Then, having noticed that our ice-floe had drifted 10 miles southwards, we left it on July 31, and after having covered the remaining 23 miles in our *baidaras*, landed on August 3 on Bennett island, at Cape Emma.

"According to the survey of Seeberg, who has also determined the magnetical elements both here and on the journey—in ten places in all—Bennett island is a plateau, not higher than 1500 feet. By its geological structure it appears as a continuation of the plateau of Middle Siberia, which is built up, here also, of very ancient marine deposits (Cambrian), pierced by irruptions of basalt. In places one finds, under the sheets of basalt, deposits of brown coal with relics of vegetation, namely conifers. In the valleys of the island, bones of mammoths and other Quaternary-period animals, washed out of the deposits, are found occasionally.

"As to the present inhabitants of Bennett island, they are, besides the temporary visitor, the walrus, the polar bear and the reindeer. A herd of some thirty of the latter wandered on the rocky feeding-ground of the island. We fed upon them, and made out of their skins the fur cloth and the boots required for the winter journey. The following birds stay here: two species of *Somateria*, one sand-snipe, one bullfinch, and five species of gulls, including the roseate one.

"As for migratory birds, we saw one eagle which flew south to north, one

* I suppose that all dates are given in Baron Toll's statement in Old Style, and therefore add to them thirteen days.—P. K.

falcon which flew north to south, and geese whose flock went also north to south. Owing to fogs, we could not see the land wherefrom these birds came; neither could we see Sannikoff's Land, any more than during our last navigation.

"We are going to leave here the following instruments: a reflecting circle with artificial horizon, a Krause's inclinator, the anemometer, the photographic apparatus 'Norah,' and some others.

"To-day we are going southwards. We have provisions for fourteen to twenty days. All in good health. 76° 38′ N. lat., 149° 42′ E. long.

"(Signed) Baron E. Toll.

"Bay of Paul Köppen on Bennett island,
"October 26 [November 8], 1902."

This is the last that has been heard of the indefatigable explorer of the far North, to whom science owes already so much concerning the physical conditions of the Arctic Regions during recent geological perio 's. The remarks which we find, even in the above short sketch of Bennett island, are in themselves of the greatest value. They show that the same old continent, which we see on the Vitim and in North-Western Mongolia, once extended far beyond the present northern limits of Asia; and that the relics of this continent have now, in the far North, the same character as I saw on the Vitim; namely, a backbone of old, probably Cambrian, crystalline rocks, levelled in the course of ages to the plateau form, and covered in places with relics of Tertiary woods (I found on the Vitim near the Holoi, petrified wood, which Fr. Schmidt identified as *Cypressonoxylum aleuticus*); these relics, in their turn, are covered with Post-Tertiary layers of basaltic lavas. Consequently, even in this high latitude (beyond 76° 38′), possibly at the northern extremity of what was then an immense continent, which spread from Middle Asia north-eastwards, coniferous trees used to grow during the Tertiary period; a result the importance of which every geologist will appreciate.

No news having been heard of Baron E. Toll for the nineteen months which have elapsed since he left the above document on Bennett island, we must admit, with the deepest sadness, that little hope now remains that we shall ever see the two gallant explorers, Toll and Seeberg, with their faithful hunter-companions, returning in our midst to hear our admiration of their work.

P. Kropotkin.

REVIEWS.

EUROPE.

Geology of Austria.

'Bau und Bild Oesterreichs.' By Carl Diener, Rudolf Hoernes, Franz E. Suess, and Victor Uhlig. Also published in four parts separately, viz. 'Bohemia,' 'The Eastern Alps,' 'The Carpathians,' and the 'Austrian Plains.' Vienna: F. Tempsky; Leipzig: G. Freytag. 1903. Pp. xxiv., 1110.

The names which appear on the title-page of this work are in themselves a guarantee of excellence. Each of the authors has taken charge of a district with which he is especially familiar, and the result is of that high standard which might have been expected. With the great advance which has been made by descriptive or regional geology during the last fifty years, it is no longer possible for one geologist to master the detailed stratigraphy of more than a small part of the European continent. A compendium of this kind, giving an account of all that has been done to elucidate the structure of a certain area, becomes more and more

necessary as time goes by. This book will be of the greatest service to all working geologists and geographers, for it brings to a focus our knowledge of the geology of the Austrian Empire, and with its ample bibliographical references renders it an easy matter to consult the more special monographs and maps. Though the volume is a bulky one, it contains no more than a useful *précis* of the literature. It is everywhere condensed, and its authors may be congratulated, not only on the judgment they have shown in selecting their materials, but also on the literary skill with which they have woven them together. Prof. Diener's chapters on the Tyrol may perhaps be cited as the best instance of this; the intricate nature of the geology, together with the numerous controversies which have arisen regarding it, and the long list of famous geologists who have contributed to its investigation, make this district a centre of interest to all geologists, and it is a boon to have a clear, brief, and reliable account of the latest views on the subject. In his difficult task, Prof. Diener has attained a very large measure of success, and while on the whole he takes up a conservative attitude, he is far from adhering slavishly to the views of the earlier school of Austrian geologists. Prof. Uhlig's account of the Carpathians is almost equally interesting. It would be difficult to point to better examples of the art of explaining complex geological structures than it affords. But the whole book is thoroughly readable, and should be so even to the unscientific, for no great knowledge of geology is assumed on the part of the reader, and the sections and photographic views with which the book is illustrated help greatly to give point and meaning to the statements in the text. It would probably have been well had more sketch-maps been provided, for the larger-scale geological maps are somewhat inaccessible to the ordinary man, and the topographical details into which the authors enter are often confusing. A more serious deficiency is the absence of a general index, as the chapter of contents, though full, is by no means sufficient to serve in its place.

The principal aim of the book is to give an account of the geological structure of the Austrian empire. Geographical evolution and physiographical development are treated of incidentally, and in some cases with considerable detail. The palæontology of the various formations described is hardly considered at all, and petrography also is relegated to the background. These are probably no more than necessary restrictions in the scope of the work; had they been relaxed, it is certain that the volume would have been still more bulky and far less readable than it is. Controversial subjects are mostly sketched in outline, the reader being referred to the original papers. In the same way, the history of the advance of geological research is not allowed to occupy more than a small proportion of the space, though it is nowhere neglected. An eloquent introduction has been contributed by Prof. E. Suess, who remarks on the rich variety of Austrian geology and the many eminent names which are linked with its investigation.

J. S. F.

ASIA.

Manchuria and Korea.

'Manchuria and Korea.' By H. J. Whigham, author of 'The Persian Problem,' etc. London: Isbister & Co. 1904.

Under this title we have a graphic description of the more important points of the political situation, as they appeared to a traveller in the Far East. One wishes that the author had been able to see the book through the press himself, as, no doubt, certain small details would have been corrected. The title would have been better with some amplification, as the bare names of the countries convey no adequate idea of the matter between the covers. The opening chapters

are the usual refrain, which one hears everywhere amongst Britishers in the Far East, viz. "The British Government has badly neglected the interests of its people." One wonders why such a keen observer did not perceive and place on record that, in addition to the slackness of the Government, the ordinary British merchant has not risen to the occasion with his traditional alertness. The author might have instanced a leading British hong in Newchwang to show how adverse circumstances could be overcome, first and foremost, by the active members of the firm being adepts at speaking, not only Chinese, but French, and, thus, able to do business direct with natives and high Russian officials. Also, having one member conversant with Japanese customs and language, they have successfully competed for Japanese business. Whereas the usual practice is for the British merchant to do everything through the medium of the English-speaking natives; thus handicapping himself when competing with the enterprising Japanese or persevering Germans.

The book is well worthy of careful study. Point after point is clearly brought forward; thus attention is called to the fact that the heavy goods trade of the port of Newchwang must continue, whereas a new class of export and imports will make Dalny flourishing. The descriptions of the richness and beauty of the country are by no means overdrawn, especially when seen in summer or early autumn.

The Russo-Chinese Bank has done something, and might do much more, to mitigate the barbarous systems which have grown up through lack of a proper currency. A very great impetus has, undoubtedly, been given to trade by the railway and bank, but everything has been kept back by the idea of a great war, which possessed every native merchant.

The concluding chapters on Korea and the conditions in that unfortunate land, are well worthy of consideration, whilst the remarks on the German policy in Shantung deserve special attention. This book should be read together with 'The Russian Advance,' by A. J. Beveridge. R. T. T.

AFRICA.

A Word-picture of Nyasaland.

'Nyassaland under the Foreign Office.' By H. L. Duff. London: George Bell. 1903. Pp. xvi. and 422. *With a Map.*

Descriptive topographical work may be divided into three classes—that which leaves no impression of the subject on the mind ignorant of it; that which leaves a false impression; and that which leaves an impression which the mind, though ignorant, feels to be accurate. The first is provided by the class of traveller who adheres too closely to deeds and the use of the first person; the second may be the outcome of various characteristics from inborn inaccuracy to local patriotism; the third is given to that true observer who has at command a flow of convincing language. In this class, and highly placed in it, stand Mr. Duff's work on Nyasaland. Avoiding controversy, avoiding political or scientific discussion, he confines himself purely to things seen, and his words carry conviction that they represent these things, and therefore Nyasaland, not dreamland.

He dismisses very briefly the circumstances of Nyasaland previous to, and leading up to, the establishment of the British Central Africa Protectorate. They have been detailed by men who took a share in them, and Mr. Duff writes no more about them than is necessary to introduce his subject. Then the reader is led up the Zambezi, through the network of channels above its mouth, and up the boldly

sweeping united stream to which these give place. The journey ends in the comfortless *machilla*, or hammock, borne by native bearers, at the tin-roofed township of Blantyre. In his vivid accounts of the physical characteristics of those parts of the country with which he is most intimate (principally the Shiré highlands), the author so far looks with the eye of the scientific topographer that the reader is able to follow very clearly the marked divergence between region and region dependent primarily upon variation of altitude—a divergence which is perhaps hardly conceived by the majority at home. The "fine rolling down country," with its keen climate (where the familiar Scottish appearance of the burns impelled Mr. Duff to essay their pools with a trout rod), which occurs in the Shiré highlands, also marks, on a more extensive scale, an abrupt transition stage between the scrub forest bordering Lake Nyasa and the plateau proper of Northern Angoniland, on which, again, a waterless and uninhabited tract occurs in the direction of North-Eastern Rhodesia, beyond the Linyangwa river. The chapters on flora and fauna are equally acceptable to the general reader, discussing classes in descriptive terms rather than individual species (except a few of the more noteworthy) under scientific terms. On the various peoples which go to make up the native population, Mr. Duff, as having administered districts where he was brought into close contact with most of them, writes fully and authoritatively. His impressions of the majority of them are favourable, and it is to be gathered that his personal relations with them were excellent, and quite as intimate as is needful for satisfactory administration; and this fact amply justifies the sound remarks on the only controversial matter of practice which the author allows himself to touch—the work of the missionaries. Finally, Mr. Duff is no less sportsman than administrator, and along with his discussion of the fauna he gives a few experiences of his own indicative of the kind of wildfowl and big-game shooting to be expected, views with satisfaction the establishment of the two game reserves near Chiromo and near Lake Chilwa, and does not omit to indicate the variety of possibilities offered to the angler in Nyasa.

There is little that is suggestive as regards the future of Nyasaland in this book. Generalities apart, there are only noticeable a few such hints as the rather noteworthy one that, from a comparison of conditions in India, indigo might possibly be grown on the cultivated and cultivable lands bordering the Shiré river. For the rest, the book stands by its descriptions, the excellence of which balances the fewness of illustrations, though of these the few are good. The only feature in which the volume is stinted as regards appearance is, as too often, the map.

O. J. R. H.

Herero Land.

'Bergtouren und Steppenfahrten im Hererolande.' Von Franz Leiner. Berlin: Süsserott. 1904.

This little book is the outcome of journeys in German South-West Africa undertaken by the author—a journalist with some knowledge of the adjoining British territories—for the purpose of studying the actual condition of affairs in the German possession. It is particularly *à propos* at the present time, seeing that the routes led through north-eastern Herero Land, the headquarters of the present revolt, to the causes of which the writer pays special attention. He takes an unbiassed and independent line in his discussion of existing administrative methods, and holds that there can be no peace in the country without a German occupation of Ovambo Land. Both by its descriptions and illustrations, the book helps considerably towards an understanding of the nature of the country and its people.

AMERICA.

The Rockies of Canada.

'Climbs and Explorations in the Canadian Rockies.' By Hugh E. M. Stutfield and J. Norman Collie. London: Longmans. 1903.

The geographical results contained in this volume have to some extent already been made familiar to the readers of this *Journal* by the three interesting papers of Prof. Collie, describing his work in the Canadian Rockies since 1897. The map accompanying the volume is also a reprint of that which appeared in the May number for 1903, while some of the mountain ascents recorded have already been described by other writers in the pages of the *Alpine Journal*.

The present book, however, is intended to appeal to a wider circle of readers, and is a good example of a class of mountaineering works, of which a considerable number have been published in recent years. In the first chapter we have a short history of previous explorations in the district. This history is intimately bound up with that of the fur trade, and records the commercial struggle between the rival firms, the Hudson Bay Company and the North-West Company, till in 1821 the latter became merged in the former. Of individual explorers, we have Sir Alexander Mackenzie, who first actually crossed the continent in 1793, and the interesting diary, recently published, of Alexander Henry between 1799 and 1814, while the work of the well-known geographer, David Thompson, occupied about the same period. From this time to 1858 little seems to have been added to the knowledge of the western valleys, except through the journey of Captain Palliser in 1857, the results of which were published as a report to the Houses of Parliament. In 1886 the Canadian Pacific Railway was opened, affording access to the heart of the district.

The volume records four expeditions between 1897 and 1902, the first being made in 1897 by Dr. Collie, Messrs. Fay, Dixon, Parker, C. S. Thompson, and others, to the Selkirks, as was that of a subsidiary party consisting of Baker, Collie, and Sarbach to the Howse pass and Freshfield group further west. The chief incidents in this expedition were the temporary retirement of Thompson into a crevasse during the ascent of Mount Gordon, from which he was only rescued by Collie with considerable difficulty, and the ascents of Mounts Gordon, Balfour, and Freshfield. The return journey was for the first time made with ponies by Baker pass into the Kicking Horse valley, where the railway was joined at Field.

In 1898 Dr. Collie was back again with Stutfield and Woolley in search of Mount Hooker and Mount Brown, and in order to explore the unknown mountain country where the Saskatchewan, the Athabasca, and the Columbia take their rise. They travelled to the Saskatchewan *viâ* the Pipestone and Siffleur creeks in search of Mount Murchison, reported to be nearly 14,000 feet high, and the highest summit of the Canadian Rockies. The mouth of Bear creek, at the confluence of the three principal branches of the North Saskatchewan, must offer ideal scenery, and appears to be an ideal spot for a future tourist centre. The output from here followed the North fork. During this expedition a few bighorn were shot, and the Athabasca peak, 11,900 feet, Mount Diadem, 11,500 feet, were ascended; also the Dome, 11,650 feet, this latter peak, the hydrographical apex of the Rocky mountains, shedding its waters into the Pacific by the Columbia, into the Atlantic by the Saskatchewan, and into the Arctic ocean by the Athabasca. The return was made by the Bow river to Laggan. The question, however, of the positions of Mount Hooker and Mount Brown, the two reputed monarchs of the Rockies, was no nearer being settled by this expedition; but, curiously enough, they were at length discovered in the pages of David Douglas' journal, and from his

description there can be no doubt that what he ascended was a peak of 9000 feet, not 17,000 feet.

The summer of 1900 found Collie and Stutfield back at Donald on the Canadian Pacific, with Mr. Sydney Spencer. This year they endeavoured to reach Mount Bryce and the Columbia group from the west by way of the Bush River valley. They were unlucky, however, from the start, and they lost their best axeman by a fall from his horse. This route appears to have combined the maximum of discomfort in the matter of flies, mosquitoes, bull-dogs, muskegs, and devil's club creepers, with constant rains and flooded rivers, which caused additional delay; the result being that after twenty-three days out they found themselves still 15 miles from the Columbia ice-field, every step of which would have to be cut with the axe. They therefore reluctantly returned. The chief result of the expedition, beyond demonstrating the inconvenience of this route, was the addition of some 14 miles to the map of the upper Bush valley. The low level of the lower Bush valley was thus explained, and it was also found to drain the whole of the snowy range from Mount Freshfield to the north end of the Columbia range. It would be interesting to know how far down this valley traces of former glaciation were observed. The intensely folded character of the rocks even in the lower Bush valley points to a wide area of mountain elevation, on which, however, denudation appears to have been at work for a very long time judging from the well-established drainage. Altogether, from a physical and scientific point of view, the district would probably well repay further exploration. After returning to Glacier House several peaks were ascended, including Mount Edith, Mount Sir Donald, and Swanzy peak. The description of lakes or swamps on the summit of divides like the Athabasca pass and the Saskatchewan recalls similar phenomena in the Alps and elsewhere, and these appear to be the rule rather than the exception. They are probably connected with the capture of the original headwaters of one river by another and the reversal of its drainage, thus depriving it of the means of scouring out the accumulations from landslips and lateral torrents. The last trip recorded in this volume was made in the summer of 1902. The party journeyed by way of Bear creek to the Freshfield glacier (ascending Mount Murchison on the way), where they joined forces with the Rev. James Outram and Christian Kaufmann. The combined parties ascended Mount Freshfield and Mount Forbes, the latter affording decidedly difficult climbing. The height of all the mountains was found to have been much overestimated, Mount Murchison being reduced to 11,300 feet from 15,781 feet, and Mount Freshfield to a bare 11,000 feet, while Mount Forbes was lowered to 12,000 feet.

The parties then separated. The author's outfit, after ascending Howse peak, explored the Lyell ice-field and the Glacier lakes, finishing up with the ascent of Neptuak, in the Victoria group to the south of Laggan.

The book is full of excellent photographs, which give a capital idea of the scenery, which must indeed be strikingly grand. The mountains themselves appear to resemble those of the Tyrol, but the proximity of these to beautiful lakes surrounded by magnificent forests and luxuriant alps imparts a special and unique character to the scenery of the Bow valley. If we add the further attraction of bighorn and mountain goats, bear, wildfowl, and trout, there would seem to be everything provided to make the district one of the most popular playgrounds of the new world, always omitting the mosquitoes, bull-dogs, and muskegs.

E. J. G.

HARRIMAN ALASKA EXPEDITION.

'Glaciers and Glaciation.' By G. K. Gilbert. Vol. iii., pp. xii., 231. New York: Doubleday, Page & Co. 1904.

So many accounts of the glaciers of Alaska have appeared in the last few years from the pens of Canadian and American geologists, that it would seem difficult for the present to write anything about them that is both important and new. Prof. Gilbert has evidently felt this difficulty, for, owing partly to this cause and partly to the shortness of his visit, his actual observations were practically confined to corroborating the statements of other authors and collecting the most recent data regarding the periodical variations of the length of the glaciers. Most of what he has observed has been observed and described before, and, aware of this, he has exercised a laudable brevity in the narrative of his work. But it is in the two concluding chapters of the book, in which he passes on to the general considerations regarding the nature and power of glacial erosion and the geographical development of the Alaskan seaboard, that the interest of the volume centres. He recognizes the existence of an old peneplain, which, after it had been reduced to sea-level, was uplifted to heights of 3000 to 5000 feet and carved into valleys and ridges. Skirting the shores are the remains of lower plains, which are, however, of small importance. The intense glaciation to which the whole area has been subjected in Pleistocene times has produced a typical fiord coast, very similar in all essentials to that of Norway and West Scotland. The debated question of the origin of the fiords is discussed in a masterly fashion, and the conclusion at which the author arrives is, that they are old valleys which bear unmistakable evidence of having been greatly deepened and modified in their contours by ice-erosion. He compares and contrasts the work of running water and of ice in modelling the relief of land surfaces, and comes to the interesting conclusion that, despite all qualifications, the hanging valley is the most important witness yet discovered to the magnitude of the work accomplished by the glaciers of the Pleistocene. The importance of this verdict from so great an authority on physiographical processes cannot fail to be appreciated by all who are interested in the subject.

J. S. F.

POLAR REGIONS.

THE SECOND NORWEGIAN NORTH POLAR EXPEDITION.

'New Land: Four Years in the Arctic Regions.' By Otto Sverdrup. Translated by Ethel Harriet Hearn. London: Longmans. 1904.

Captain Sverdrup's paper, read at the Royal Geographical Society, April 27, was published in the *Journal* for July, 1903. In that communication Sverdrup gave a summary of the geographical and scientific results of the recent Norwegian Polar Expedition in the *Fram*, 1898–1902. The two volumes now published, with maps and excellent illustrations, give full details of this thoroughly successful Arctic expedition. Its original object was to enter the polar area through Smith sound, to examine the north-west coast of Greenland, and to attempt the circumnavigation of that island-continent. The conditions of the ice in Kane basin during the navigable season of 1898 prevented any advance northward, and the *Fram* was forced to winter on the north-east shore of Ellesmere Land. Sverdrup was no more fortunate in his attempts to get northward in the following year. After these two unsuccessful endeavours, he abandoned his original project, and, sailing southward, re-passed Smith sound and entered Jones sound. There on the south shore of Ellesmere Land the *Fram* remained for the next three years. From his ship in Jones sound, as the base of operations, Sverdrup explored the hitherto unknown area that lay between the most north-eastern point reached by Belcher's expedition

in 1853, and that gained by Aldrich in 1876, on the north-western coast of Grant Land. The three years of strenuous enterprise passed by Sverdrup and his companions in exploring the wide gap were crowned by the most complete success, and the lately vacant space on our maps is now filled with new lands and islands. The survey of both sides of Jones sound and Cardigan strait; the accurate delineation of the entire west coast of Ellesmere Land, with the examination of its great fiords; the tracing of the south shore of Grant Land to its western extremity; the discovery of a large island, separated from Ellesmere Land by Eureka sound and Nansen sound, named Axel Heiberg Land, after the patron of the expedition; and the finding of two more considerable islands still further to the westward, are valuable additions to geographical knowledge. The explorations of the expedition embrace an approximate area of 100,000 square miles. We may now assume that the outer fringe of the Parry archipelago, from Ireland's Eye of McClintock, to Aldrich's Cape Columbia, has been determined, and it is extremely improbable that any land exists between these islands and the north pole. The "ancient ice, blue and slippery," which Sverdrup describes as pushed up against the western or exposed side of Axel Heiberg Land, with the absence of icebergs, points to the same conclusion.

This "ancient" or "old polar ice with enormously high melted-off ridges and dales," is obviously identical in character with the blue massive floes of extraordinary thickness met with on the northern shores of Grant and Grinnell Lands, and called "palæocrystic" by the Nares Expedition.

Of the small ship's company, sixteen souls in all, that left Norway on board the *Fram*, four were capable young men of science—a cartographer, a botanist, a zoologist, and a geologist, in addition to the medical officer, who unfortunately died before the end of the first year. The short preliminary reports given by these gentlemen on the geology, botany, zoology and meteorology are valuable additions to our knowledge, but are merely precursors to the fuller information which will be published when the entire collections have been worked out.

The geological investigations of Herr Schei possess special value, for he is, as far as we are aware, the first trained geologist who has explored in the Parry archipelago. His determination of the rocks from Cape Sabine as far as Norman Lockyer island, which is the limit of his advance northwards, agrees with that of the Nares Expedition. After entering Jones sound the entire field of his investigations is fresh, and his sketch-map shows what an immense area has been examined. His discoveries prove the existence of Archæan rocks in the south of Ellesmere Land, whilst Cambro-silurian, Devonian, and Carboniferous formations occupy extensive areas, but the east side of Heiberg Land and the opposite shore of King Oscar Land, with both sides of the entrance to Greely Fiord are considered by Herr Schei to consist of Mesozoic formations. Tertiary deposits were likewise met with, and they in all probability are the equivalents of the Miocene strata already known to occur in the vicinity of Discovery bay, in Grinnell Land. The phanerogams of the Arctic Regions have been so thoroughly worked that beyond increasing our knowledge of distribution, the botanist of the expedition adds but a few species to the list of flowering plants already recorded from the archipelago, but the immense collections of mosses, seaweeds, fresh-water algæ, lichens, and fungi made by Herr Simmons will be a welcome addition to our knowledge of these lower forms of vegetation. It was hardly to be expected that Herr Bay, in his interesting report, would add greatly to our previous knowledge of the vertebrate fauna of the archipelago, but the examination of the dredgings will doubtless prove of interest and scientific value.

There can be no question that the valuable results of this enterprise, never

surpassed in its thoroughness and completeness by any previous Arctic expedition, is due to the almost unrivalled experience and admirable qualifications of the leader, and also, in Sverdrup's own words, to those two indispensable adjuncts to the carrying out of polar research, "ski and dogs." H. W. F.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Volcanoes.

'Der Vulkan: die Natur und das Wesen der Feuerberge.' By Prof. Hippolyte Hass. Pp. 340. With Plates. Berlin: Alfred Schall. 1904.

In this little book Prof. Hass has given us a succinct and readable account of much theoretical and controversial matter regarding the nature, origin, and mechanism of volcanic action. It is evidently written *à propos* of the eruptions in Martinique, and is meant for the general reader, but is on the whole more suited to the requirements of the student, who will find in it a summary of recent speculations, most of which have not yet found their way into the text-books. It is illustrated by a few well-chosen plates, and would have certainly been improved by fuller references to the literature of the subject and a more adequate bibliography. J. S. F.

Plant Geography.

'A Manual and Dictionary of the Flowering Plants and Ferns.' By J. C. Willis, M.A. Second Edition. Cambridge: University Press. 1904.

This is, perhaps, the most useful botanical manual in existence for the purposes of travellers and others, who, without being professed botanists, are desirous of acquiring some knowledge of the general principles of the morphology, classification, and distribution of plants. Without being overloaded with detail, Part I. brings out with great clearness these broad principles, giving, besides, some useful information on economic plants; while Part II. consists of an alphabetical dictionary of the principal orders, genera, etc., in which the salient facts regarding each are concisely summarized. The chapter on distribution is particularly instructive, from the care taken to explain the life-conditions of plants and their relation to external environment. There are useful hints on collecting plants, though some will be surprised to find so much countenance given to the popular notion that *pressure* is a principal requisite in the preservation of specimens.

GENERAL.

French Missions.

'La France au dehors. Les Missions Catholiques Françaises au XIX^{e} siècle. Publiées sous la direction du Père J. B. Piolet, S.J. 6 vols. Paris: A. Colin. 1902–1903.

In so many quarters of the globe have French missionaries (even more, perhaps, than those of any other nation) been the earliest pioneers in remote and uncivilized districts, that a general history of the missions carried out by them, such as is presented by the sumptuous work now before us, cannot fail to include much that is of interest, both to the geographer and ethnologist. Although the nineteenth century had not so much to show as some of its predecessors in the way of actual exploring work on the part of the French fathers, their work in many out-of-the-way regions, as, *e.g.*, the frontiers of China and Tibet, and a large number of localities in tropical Africa, have added much to the general stock of knowledge about them, though the information collected has not always been readily accessible. The present work possesses an authoritative character, as it is the outcome of the co-operation of all the French Catholic societies, and it is profusely illustrated by photographs of places, scenery, and native types, some of much interest from the excellent idea they convey of the nature of the countries depicted

THE MONTHLY RECORD.

EUROPE.

Origin of the Irish Counties.—Among the many drawbacks entailed by the too common dissociation of history from geography, is the failure of the ordinary geographical text-book to throw any light on the origin of the modern political or administrative divisions of the countries described. This want is supplied, as far as the Irish counties are concerned, by an interesting sketch of their origin and delimitation, supplied by Mr. C. L. Falkiner in the *Proceedings of the Royal Irish Academy* (1903, part iv.). It is, perhaps, not generally recognized how comparatively modern and artificial the existing administrative subdivision of the island is, and how little it has to do with the conditions of tribal division which made their influence felt in the not very remote past. It is otherwise with the provincial divisions, which represent in the main a very ancient native partition, based on no great natural boundaries, but rescued from extinction by its adoption for ecclesiastical purposes in the twelfth century. Thus down to the reign of James I., when Meath ceased to be reckoned a separate province, the provincial divisions corresponded closely with the limits of the five ancient kingdoms sometimes called the Irish Pentarchy. The first partition into counties, of parts of Leinster and Munster, is generally ascribed to King John, but Mr. Falkiner points out that, though these divisions were probably known as geographical areas, they can hardly have formed counties in the modern administrative sense until considerably later. Five were, in fact, included in the single "liberty" or county palatine of Leinster, a territorial division belonging to quite a different category. By the earliest grants to the great nobles, the English kings delegated their authority to these, and even where sheriffs were appointed within the limits of their jurisdiction, the authority of the latter did not extend beyond the limits of the Church lands. Although some attempt to extend the system of shires was made in the reign of Edward I., it seems to be the fact that from the time of King John to that of the Tudors no new county was formed, or, if formed, that it did not survive; and that no sheriff was created for any new district, with the single exception of the subdivision of Connaught into the separate districts of Connaught and Roscommon. The area under the direct control of the Crown was, in fact, narrowed continuously, and it was not till the reign of Henry VIII. that any real steps were taken to restore the sovereign's supremacy. The first real addition to the list of Irish counties was made in Mary's reign by the formation of the King's and Queen's counties, and though the actual delimitation of the counties was not actually settled till the reign of James I., the shiring of Ireland was practically the work of the last two Tudor sovereigns (for Mary's policy was continued by Elizabeth), carried out under the supervision of three eminent statesmen—the Earl of Sussex, Sir Henry Sydney, and Sir John Perrot. The last of the great mediæval jurisdictions to fall before the new *régime* was that of Tipperary, where the Ormond jurisdiction was not finally brought to an end until 1715.

Traffic on the Rhine.—The total drainage area of the Rhine is about 86,640 square miles, of which 61,590 lie in German and Swiss territory. Dr. F. Wickert describes the traffic on the waterways of this latter area, with full details concerning the hindrances to navigation, the draught and tonnage of the vessels employed, the quantities and nature of the goods transported, etc., in the *Forschungen zur Deutschen Landes- und Volkskunde*, Bd. xv. Heft. 1. The navigation on the Lake of Constance, the Zeller lake, and the Rhine down to Schaffhausen is the most important in Switzerland. Low water, fog, etc., sometimes interfere with

navigation on the lake, and high water on the Constance-Schaffhausen section, the bridges at Constance and Stein being very low. Between Schaffhausen and Basel many rapids and sandbanks encumber the channel, and between Basel and Strasbourg the rapid fall, shallows, and other obstacles are very unfavourable to navigation, and the through traffic is diverted to the Rhine and Rhone canal. More favourable conditions prevail between Strasbourg and Mannheim, and, though passenger traffic has not been able to compete with the railways, it has proved possible to increase the goods traffic by means of tugs of shallow draught; and probably the opening of a new harbour on the Sporen island will cause a further improvement. From Mannheim downwards the traffic is considerable, and fairly constant. Interruptions are occasionally caused by low or high water, but as a rule of no great importance. Sometimes the larger vessels cannot proceed above St. Goar, unless part of their cargo is unloaded. A period of continuous low water in the autumn of 1898 did, indeed, result in a marked reduction of the traffic. The goods transported upstream are chiefly coal (English as well as Ruhr coal), wheat, and petroleum. Of all the ports Mannheim is the most important. In 1900 the goods landed and shipped at Mannheim, and at Ludwigshafen on the opposite bank, were of the weight of 7,662,451 tons, and were some 500,000 tons in excess of the goods dealt with in thirty-one other Rhine ports, and even more than at Berlin. This is owing to its position near the mouth of the Neckar and at the head of navigation in larger vessels, as well as in the fruitful plain of the upper Rhine, in which several industries flourish. Of the tributaries of the Rhine the most important for navigation are the Main and the Neckar. Dr. Wickert also treats of the other tributaries and several canals connected with the Rhine system. An explanation of the fact that the imports by water at most of the Rhenish towns far exceed the exports would be interesting.

Geography of the Mälar District.—Dr. Gunnar Andersson has treated at length of the configuration of the Mälar region in a long essay reprinted from *Ymer*. The chief factors in its formation are an exceedingly ancient and extensive valley excavation by means of water-erosion, in a direction from north-west to south-east, and a network of faults which, over a great portion of the Mälar neighbourhood, crosses the old valleys and has completely changed the drainage system. Besides these, the effect of the inland ice must be taken into account, which has modified the former configuration both by its erosion and by the deposition of loose material; and the sea, which at the end of the Glacial period and in later times covered a large part of the area, has deposited detritus in the valley bottoms and contributed to the present aspect of the landscape. Dr. Andersson describes the chief river-valleys which formerly extended south-eastwards beyond the Mälar basin, until they were interrupted and their streams deflected by faults, and also traces the chief faults, the majority of which run east and west, the northern sides having sunk. The total subsidence he believes to have been nearly 1000 feet. The first development of great erosion valleys no doubt took place in Palæozoic times, but the chief features of the present orography came into existence in the Tertiary period. Several hundred, or even 2000, yards of rock have been denuded from the surface, and the form of the surface must have been altered while the valleys gradually sank through the strata. The valleys have also changed their direction, perhaps in connection with the formation of fissures and dislocations. The severance of "dead" sections of valleys, common over a great part of the area, cannot have occurred in a very remote geological period, for denudation and the new drainage system caused by faulting would have obliterated the older configuration. It is remarkable that with the exception of the flooded basins of Mälar and Hjälmar, lakes are almost absent from the most depressed part of the region, whereas they

are numerous on the higher parts. De Geer supposed that the beds of Mälar sandstone and the Silurian strata which formerly covered the country when fissuring and subsidence took place, were preserved from disturbance for a longer time within the depressed area than outside. Dr. Andersson, however, believes that the fissuring and faulting took place when most of these rocks had been denuded, and furthermore declares that lake basins are as numerous in the low area, but are filled with Quaternary moraines and clays.

Density of Population in Herzegovina.—In his scientific communications from Bosnia and Herzegovina, O. Tauker, of Vienna, investigated the relation of the human settlements on the land to the geological constitution of the soil. Now in like manner Dr. Georg Danes, of Prague, has published the result of his careful researches, which have to do more particularly with the southern part of the territory ('Travaux géographiques Tchèques,' No. 3, Prague, 1903), in respect of the diversity in density of population, its relations to the mode of settlement, the employment of the inhabitants, and so on. In the form of settlement he distinguishes (*a*) single houses or groups of houses scattered over wide areas; (*b*) compact settlements, among which are reckoned towns; and (*c*) a transitional form between the two, the "Rand" villages. These lie within the great "poljes," characteristic of the karst nature of the surface of the land, and range themselves along the borders of the polje lands, where they are protected from the inundations of the middle parts. The agricultural population constitutes 90 per cent. of the whole, and the average density is 56 to a square mile. On the cultivated area, however, which occupies only 14 per cent. of the whole, the density rises to 400 to the square mile. This clearly indicates, in view of the primitive state of agriculture, the importance of the cattle-rearing industry, which thrives on the 41 per cent. of meadow-land and the 43 per cent. of forest, the foliage of the latter serving goats especially in the way of fodder. Of the agricultural population, 26 per cent. is made up by "Kmetones," hereditarily settled on the soil of the landowners, and to the oppressive regulations to which they are subject must be ascribed the neglect of agriculture as opposed to cattle-rearing. Only tobacco is carefully and profitably cultivated. The number and size of the inhabited places (Ortschaften), and therefore also the density of population, decline with the rise in elevation. At 5000 feet high the upper limit of permanent human habitation is reached. Since 1879 the number of Mohammedans has remained stationary, and relatively has seriously declined. The increase of Greek Catholics has almost kept pace with the average increase of the population of the whole country. The number of Roman Catholics, on the other hand, has increased absolutely and relatively. This is to be accounted for by the fact that the majority of the immigrants are Roman Catholic. The total increase from 1879 to 1895, apart from immigration, amounts to something over 31 per cent., showing a yearly average of not quite 2 per cent. As regards the future, the unfavourable social situation of the rural population may perhaps cause a diminution in its number, while the improvement of communications, etc., may, on the other hand, tend to the growth of the urban population and other displacements. A map of the human settlements on the scale of 1: 400,000 accompanies the text.

ASIA.

Journey in North-West Yunnan.—An interesting journey in North-West Yunnan was carried out in 1902–3 by Mr. G. Litton, British Consul at Yunnan-fu, already known to geographers for his journey, a few years ago, through some of the less-known parts of northern Sechuan. The journey was not undertaken for purely geographical purposes, and considering the way in which the province was covered

by the routes of the survey parties of Major Davies, Captain Ryder, and others, little in the direction of improving the map could be of course accomplished by one who was not a professional surveyor. Still, Mr. Litton's routes led in part over ground not covered by the survey parties, and bisected several of the blank patches left in the map published in the *Journal* to accompany Captain Ryder's paper. The chief value of Mr. Litton's report presented to Parliament in November last ('China,' No. 3, 1903) consists, however, in the full and instructive details supplied on the nature of the country, its people, and trade relations, points to which Captain Ryder could give but brief attention in his paper read before the Society, owing to the very large extent of ground covered by his routes. From his starting-point at Yunnan-fu Mr. Litton took a line intermediate between the great commercial road to Tali and the Yangtse, through a generally poor and mountainous country sloping north to that river. In the valley of the Kung-Hsien river, which flows through a magnificent and romantic gorge, traces of an old paved road were seen and this was once probably a main trade-route between Tali and Sechuan. Mr. Litton discusses the trade conditions of this region, and comes to the conclusion that, with the opening of Teng Yueh, much of the import trade should in future come from the side of Burma; though at present the cotton used is supplied by the local industry of the Hsin Hsing valley, south of Yunnan-fu. On the way from Pin-chuan to Tali, Mr. Litton made a *détour* to the north and visited the "Fowl's Foot Mountain," with its Buddhist temples surrounded by magnificent forest, some of them dating, according to legend, from the first century A.D. The temples are fully described, and the view from the summit is said to be of surpassing magnificence. After an account of the trade which centres at Hsia Kuan, south of Tali, and of the Minchia inhabitants of this region, Mr. Litton takes us north to the great bend of the Yangtse, first discovered by M. Bonin, by way of Hoching, a clean and well-built city with an important trade. Beyond Li-kiang-fu he went north up the axis of the Yangtse loop, passing close by the eastern foot of the great snowy mountains, to which the attention of all travellers in this region has been called. The trend of the range is said by him to be from south-east to north-west, and the Yangtse is said to cut through it on its northerly course. The river was struck near Taku, on the western limb of the bend, where it flowed steadily in a precipitous defile, with sides 100 feet deep, down which it is possible, however, to scramble. Mr. Litton urges the importance of a thorough exploration of this region by a competent traveller with plenty of time. Returning south to Chien (Kien) Chuan, he started west across the great ranges and river-valleys which traverse the borderland between China and Burma, in part by new routes. After striking the Mekong, he descended the valley for some distance, keeping for a time to the east bank before crossing the stream and joining the route of Prince Henry of Orleans. Difficult though the country is, communications were found to exist in all directions, the natives thinking little of slopes up to 45°. The water of the Mekong was very cold (39° Fahr. where tested), and during winter, the season of the journey, it is of a rich blue colour. At Meng-ku, in the Salwen valley, Chinese were found living in health, though at the suspension bridge further south they cannot live for the malaria for which the valley is noted. They do not seem, however, to extend north of about 26° 30′, beyond which the population is Lisaw. The Salwen-Irawadi watershed was crossed by the Ma Mien pass (80,500 feet), and the route to Teng Yueh (Momien) continued by the beautiful upper valley of the Shweli. The report concludes with general observations on Yunnan and its trade, with brief remarks on the interesting ethnological features of the upper Mekong and Salwen.

North-Eastern Tibet.—On his journey in 1898–99, Dr. Karl Futterer travelled

from the Kuku-nor over the southern Kuku-nor mountains by a pass lying to the west of the usual route, and along the foot of the Semenof range and the Choka plain, where he crossed Prjevalski's route in 1879–80, and came to the Hwang-ho. Beyond the river he continued his march in a south-westerly direction, crossed the Jupar mountains, the Baa river, and the Dzo-mo-lun range, and, turning afterwards to the south, reached the Hwang-ho again at the foot of the Sari-Dangerö range. Then, returning northwards, he followed the Thao-ho valley eastwards to Min-chou. The map of the country he traversed, accompanied by his diary, is published as supplement No. 143 to *Petermanns Mitt.*, 1903. Geologically, the Dzo-mo-lun system with its uniform clay-slates and sandstones extends north-eastwards to the basin of the Ta-hia-ho, which opens out to the Hwang-ho above Lan-chou, and includes the Mürgüma (Tasurchai) range, forming the watershed between the Ta-hia and the Thao. South of the Thao, the jagged crest of the Min-shan, the watershed between the Hwang-ho and the Yang-tse-kiang is evidently of a different geological structure. Its western continuation is apparently the Jawrek range, a limestone elevation gradually sinking westwards, which Dr. Futterer crossed on his way to the Sari-Dangerö range, and which, from a determination of latitude made on that excursion, should be placed on maps a degree further south. A very important part of Dr. Futterer's work was the discovery and survey of the mighty Sari-Dangerö range, part of the Amne-Machin mountains (or Tsi-shi-shan), which stretch from east-south-east within the great bend of the Hwang-ho, and were visited further westwards by Roborovski. Eastwards the Sari-Dangerö seemed to be lower, and probably the river, breaking through the range, was forced westwards by the limestone range of the Jawrek until it was able to make its way northwards again through the lower isolated hills at the end of the range, and through the Dzo-mo-lun, which has been deeply eroded. Probably it broke through this passage in a comparatively recent geological epoch.

The Kuznetski Ala-tau.—In 1902 M. Tolmachef made a geological excursion to the Kuznetski Ala-tau, during which he explored the valleys of the right-bank tributaries of the Tom river, and discovered a series of lakes, some of which appeared to have had a glacial origin. The mountains consist of a massive core of ancient crystalline limestones, quartzites, and gneisses in much disturbed strata and strongly eroded folds. Granite, syenite, porphyry, etc., betray their later origin at their contact with the limestones. Of still later date are outflows of diabase and tuffs, forming a broad zone round the above-mentioned rocks. Farther from the central elevation occur strata of Middle or Upper Carboniferous age and of Upper Devonian. The diabase also was in all probability ejected, in part at least, during the Upper Devonian period. In consequence of erosion, the mountains are now composed entirely of granite, syenite, crystalline schists, etc., while in the valleys the crystalline schists and limestones prevail, though detritus of amorphous rocks lies on the slopes above. The water-partings between streams flowing in opposite directions are broad plateaus often marshy and containing small pools, and covered with wood, meadow, or tundra according to the elevation. Above them rise the bare summits of the group. At these great heights the eroding action of snow, wind, and water is very perceptible, and the two sides of the peaks show a marked difference. The flanks facing north-west, west, or south-west rise gently and are easily climbed, except where accumulations of detritus cross the way, whereas the descent on the east, north-east, or south-east is precipitous for some distance below the summit. Below this wall is a broad slope or series of slopes, after which the surface dips gradually down to the adjacent valley. On the broad flat lie marshes and mountain pools connected by numerous streams. Here, under the precipice, snow lies almost all the year

round, even where the elevation is moderate, and *débris* falling from above rolls down the slope, and is finally disintegrated and carried away by the running water beneath the snow. Therefore accumulations are not formed so as to protect the precipice from further degradation. The Ala-tau consists of separate elevations, in some places combined into crests. The absolute height increases from west to east, rising from 800 feet above Kuznetsk to 6500 near the sources of the river Belsa, whence there is a sharp descent to the valley of the river. North-westwards the watershed, between the basins of the Tom and Chulim, winding round the sources of the White, Black, and Sarala-yus, diminishes in height; and the Little Taskil, a peak at the headwaters of the Taidon, has a height of only 3320 feet. To the north and north-east of the watershed also the elevation is considerably less. The watershed has been so long subjected to the forces of erosion that it no longer forms a continuous chain as marked on maps. The orographic contrast between the two sides of the watershed is reflected in the vegetation. On the west dark woods predominate, composed of fir (*Abies Sibirica*), among which are to be found a few clumps of cedar (*Pinus Cembra*), while on the eastern side of the watershed masses of larch (*Larix Sibirica*), together with cedar, form the forests; and the other forms of vegetation also differ.—*Izvestiya of the Russian Geographical Society*, No. 4, 1903.

AFRICA.

Northern Uganda.—Through the courtesy of the Foreign Office, we have been favoured with a copy of a report lately sent home by Colonel Hayes-Sadler, H.M. Commissioner in the Uganda protectorate, on a journey made by him through Busoga, Southern Bukedi, and the Elgon district. The Commissioner proceeded by water, in the s.s. *Sir William Mackinnon*, to Katoti's, at the head of Thruston bay, where a landing is effected through a channel cut through a thick belt of papyrus. Hence the route led by Iganga, formerly a protectorate station but now occupied by the C.M.S., to the Mpologoma lake * which receives the drainage of the country to the south and south-east almost as far as the Victoria lake. Apart from a section passing over black cotton soil, which had been rendered almost impassable by a heavy storm, the Busoga roads were found to be excellent, and a tonga can now be driven from Entebbe right up to Mbale in Masawa, with breaks at the Nile and the Mpologoma only. These are crossed in canoes and dugouts. Mpologoma is covered with dense papyrus, and, like other papyrus swamps of the country, swarms with mosquitoes, though very few were found at the rest-house on the eastern side. The lake, whose water gradually filters north-west to Lake Choga, is sparsely inhabited by a people who build their huts on the papyrus surrounded with water. Each hut is said to be provided with a hole through which the inhabitants can dive in case of danger, but none of these were seen. From Budaka, in southern Bukedi, the road runs east to Mbale, which is the headquarters of a flourishing settlement of Baganda, established here by the "Kakunguru," one of the most progressive of the Baganda chiefs. The civilization here recalled the aspect of Mengo or Toro. Mbale is on the main route from Mumia's to the Karamojo country, and there are shops kept by Indian and Greek traders as well as Swahilis. Hence Colonel Sadler went by a new route inside the Busano range to Mbai, on the borders of Save, passing by the C.M.S. and Mill Hill Mission stations at Masaba, and crossing the Busano pass at an altitude of 6800 feet. Among the hill tribes encountered most proved friendly, but the Ba Dodo

* Marked as "reported" in Sir Harry Johnston's map in the *Journal* for January, 1902. It therefore appears to have been only recently visited by Europeans.

and Ba Yobo showed themselves difficult to deal with. Colonel Sadler was struck by the population and cultivation in the Ba Yobo country, and says that all the interior ranges to the west and north of Elgon teem with huts and plantations. He was assured that the population of these tracts exceeds that of the kingdom of Uganda. At Mbai the people seemed of a different race. They were clothed—which none of the other hill tribes were—and wore a large apron of tanned leather. A grand view is obtained hence to Mount Dabasien in one direction, and in another to Lake Salisbury. Colonel Sadler says that Busoga is a lovely country, well wooded and fertile, though more unhealthy than Uganda. The people, though they make excellent porters, are apathetic and lazy, whereas the Bukedi are most industrious workers, being probably the most energetic race in the protectorate. Both countries seem eminently adapted for cotton cultivation, and steps have been taken to introduce suitable varieties. The Bukedi, who formerly cared for nothing but beads, have now begun to value cloth above everything else. A recent Protectorate report, also kindly sent to us by the Foreign Office, contains some interesting notes on the Latuka tribe and their country by Captain Barlow. Their principal habitat is a vast plain almost surrounded by hills, much of it becoming a vast marsh after heavy rain. The villages are built on hills where possible, though Tarangole, the biggest village, is on the plain. Logguren, however, the residence of the chief Lamoro, is a hill village. The people (with whom, it will be remembered, Sir S. Baker came in contact during his first expedition) are exceedingly friendly, though given to warlike exercises, and recalling the Masai somewhat in their independent bearing.

Geographical Results of the Erlanger Expedition in East Africa.—There is no one region of Equatorial Africa to the survey of which so much energy has been devoted of late years as that stretching south of Abyssinia towards Lake Rudolf and the upper Jub. Of the work of English travellers, the most important is that of Captain Maud, the results of which (based both on a careful triangulation and a large series of astronomical observations) were published in the May number of the *Journal*. Only a few months before (December, 1903, p. 698) we alluded to the careful route-surveys and triangulation of Count Wickenburg, the large-scale maps resulting from which had been published in *Petermanns Mitteilungen*. A further addition to the series has also been made by the publication, in the *Zeitschrift* of the Berlin Geographical Society (1904, No. 2), of the cartographic results of Baron von Erlanger's expedition, to which frequent reference has been made in the *Journal*. They have been worked up in the most painstaking way by Herr P. Sprigade, and are in many ways the most imposing of the whole series, the four-sheet map having been constructed on the large scale of 1 : 500,000, and even so being filled with a surprising amount of detail, which will supplement in a valuable way the results of other expeditions. We may now regard the mapping of this part of Africa to be fairly complete, in its broad outlines at least, though on some points of detail further work is still necessary. Thus, of the lakes south of Abyssinia, not one has had its contours precisely fixed, as no traveller has made the circuit of any of them, but each has sketched in the outlines from some point of vantage on the shores. The general agreement shown, however, between Captain Maud's map and Baron von Erlanger's, is a satisfactory proof that we are now approaching a trustworthy knowledge of the geography of this region. The work of the Erlanger Expedition took the form of the careful route-survey for which German travellers are noted, and seems in this case to have been of unusual excellence. The members of the party on whom it devolved had received instruction from Herr Sprigade before the expedition started, and the careful nature of their work is shown by the fact that, after covering a distance of 2700 kilometres (1680 miles), during

which the only means of measuring distance was the watch combined with the pacing of the route, the terminal point on the coast came out in almost its true latitude and longitude, as shown on the chart. In working up the results, Herr Sprigade has been able to adjust it to astronomically fixed positions otherwise obtained, and it is satisfactory to learn that in so doing the corrections of bearings involved rarely exceeded 3° or 4°. It was, perhaps, unfortunate that the construction of the map, which must long remain the basis of our knowledge of the detailed topography of this region, as it embodies the results of all previous travellers, was completed before the publication of Count Wickenburg's and Captain Maud's maps, which would have permitted one or two corrections to be made. Thus, the two portions of Lake Shalla, found by Captain Maud to be united by a strait, are still shown as independent pieces of water. The two portions of Lake Abussi, further south, seem to be also connected by a strait, as is borne out by Captain Maud, though M. de Bozas' map had separated them. The Erlanger map marks a bridge across the narrow arm of water, which seems to be shallow and swampy, so that it may have been dry at the time of the passage of the French traveller. The map is equally valuable for the more eastern region, embracing a large part of the basins of the Jub and Webi Shebeli, where it forms a valuable supplement to the work of Bòttego, Donaldson Smith, and others.

AMERICA.

The Boiling Lake of Dominica.—Mr. F. Sterns-Fadelle is the author of a paper on the Boiling Lake of Dominica, which is issued from the office of the *Dominican*, in Roseau, on that island. It is curious that this interesting phenomenon should have remained unknown until it was reached in 1875 by a party only led to explore for it by the accident of a gentleman losing his way in the forests, and approaching the lake near enough to acquire evidence of the existence of some remarkable volcanic centre. A centre was of course known to exist, and the generic name of Grande Souffrière was applied to it; but the exploring party was rewarded by the discovery of the lake, which is elliptical in form, measures about 200 feet by 100 when full, and lies in the midst of a volcanic area of some 5 square miles, at about 2425 feet above sea-level. It drains intermittently into the Pointe Mulâtre stream. It is wholly different in character from the ordinary geyser. Its waters do not rise in fountain form, but merely become ebullient, remaining so for days at a time, while at other times it is quiescent, but still a lake, not a funnel. Whether ebullition occurs at definite periods is not yet ascertained. Vertical cliffs of ferruginous soil and rock rise from the water, and no bottom was found in sounding 10 feet from the edge at 195 feet. Sulphuretted hydrogen is intermittently exhaled, and proved fatal to a visitor and guide in 1901, while other visitors have suffered from its effect. It may be recalled that the Souffrière was in eruption on January 4, 1880.

Declination of the Needle at Ayacucho.—Señor C. Oyague y Calderon publishes in *Bol. de la Sociedad de Ingenieros* of Lima, Nos. 4–6, 1903, the result of observations taken the previous year. From the mean of observations of the sun on five days in December the declination of the needle at Ayacucho was found to be 10° 37′ 15″ E. The daily variations in Peru are small, not exceeding 20′, and the annual variations, as far as can be judged from the few observations that have been made, are only from 5 to 8 minutes. Señor Oyague y Calderon promises to make known his determination of the longitude of Ayacucho in another article.

AUSTRALASIA AND PACIFIC ISLANDS.

Exploration in New Britain.—The effect of the German occupation of New Britain, or New Pomerania as it is now called, has as yet made itself felt over but

a small portion of the island, and even in the neighbourhood of the chief government station, Herbertshöh, a comparatively short distance separates the settlements from the *terra incognita* of the interior. The limits of the latter have been pushed back somewhat by a journey across the Gazelle peninsula, carried out by Herr Emil Wolff, a Government official, who recently described it before the Berlin-Charlottenburg section of the German Colonial Society (see the *Verhandlungen* of that body, vol. 8, part 2). The limit of accurate knowledge south of Herbertshöh had hitherto been the isolated peak of Mount Varzin (an extinct volcanic crater), whence the view ranges over a wide extent of primæval forest stretching to the Baining range, a gap in which gives passage to a considerable stream running southwards to the opposite sea. The tribes in this direction differ both in speech and customs from those of the northern coast region, and Mount Varzin has been the scene of fierce combats between the various sections. One of the most important is that of the Kaktai, a warlike race, which has pushed into the Gazelle peninsula from the south. In 1902, as the result of military operations, German authority was imposed on the people about Mount Varzin, and this opened the way for explorations to the southward, an opportunity of which advantage was taken by Herr Wolff, who was desirous of examining the capabilities of this region for agriculture. After passing the settlements of the Taulil, who showed themselves timid but friendly, he pushed on through dense forest, and came upon a palisaded village of the Kaktai people, whose roomy hexagonal dwellings were a great contrast to the low huts of the north-coast people. Beyond this it became necessary to cut a way through the forest, trusting mainly to the compass, and during six long marches, neither path nor human being was seen. After passing through a wild mountain region, a stream was struck which gathered force as it advanced and became a considerable river. The provisions were now spent, and matters were becoming serious, so the leader divided his party, sending one section on by land, while the rest constructed a raft on which to float down with the loads. Finally, after many difficulties and hardships, both parties arrived safely at the mouth of the Toriu, where it had been arranged for the gunboat *Mowe* to meet them. As a result of the journey, Herr Wolff considers that the interior of the Gazelle peninsula, consisting as it does of uninhabited plains of great fertility, will prove of great importance for the economic development of the colony.

POLAR REGIONS.

Arctic Exploration.—The Russian Geographical Society, with the aid of money subscribed by a private person, is organizing a new expedition for the exploration of the northern coasts of Siberia, between the Yenisei and the Lena. The head of the expedition will be M. Tolmacheff, already known for his journeys and explorations in Russian Asia.

The Antarctic Expedition: Medal for Captain Scott.—We are pleased to announce that the gold medal of the Geographical Society of Philadelphia has this year been awarded to Captain Scott for the brilliant results achieved by the British Antarctic Expedition under his leadership. It should also be mentioned that on the receipt of tidings announcing the safe return of the expedition early in April, telegrams of hearty congratulation were received from the veteran champion of Antarctic research, Dr. von Neumayer, as well as from Baron von Richthofen, who expressed their high appreciation of the success achieved by the expedition, its heroic feats and grand results.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Outline Charts on Mercator's Projection.—The Challenger Society for the promotion of Oceanography, which has its office at 58, Bedford Gardens, W.,

has under preparation a series of outline Mercator charts, suitable for use by investigators for the insertion of observations of various kinds, collected by them, or intended for the illustration of memoirs. For the latter purpose it is suggested that results may be drawn upon the charts, and the latter reduced by photo-zincography to the size of a diagram. The whole surface of the globe will be shown in six sheets, each 34 by 27 inches, the whole capable of being joined so as to form a single map. Two sheets have already been issued, covering the North and South Atlantic respectively, the price being 1*s.* 6*d.* each, or 12*s.* per ten copies.

English Edition of Suess' 'Das Antlitz der Erde.'—Geographers in this country will welcome the announcement, recently made, that an authorized translation of Suess' monumental work, 'Das Antlitz der Erde,' is in course of preparation, and will shortly be published by the Clarendon Press. It will be prepared by Dr. Hertha Sollas, under the supervision of Prof. W. J. Sollas, and will contain a preface especially written by the author.

Timberlines.—In February, 1903, the suggestion was made by Prof. I. Russell in the *National Geographic Magazine* that the terms "cold timberline," "dry timberline," and "wet timberline" might be used to discriminate between the three main classes of lines marking the limit of tree-growth. To this an objection was raised by Dr. C. Hart Merriam in the next number of the magazine on the ground that the word "timberline" had hitherto been understood in the definite and fixed signification of the *upper* limit of trees, and that any deviation from this time-honoured usage would introduce confusion. In the same magazine for January last Prof. Russell returns to the subject, pointing out the importance of recognizing, side by side with the upper limit of tree-growth, the often equally defined lines marking the lower limit. It is principally in arid regions, such as parts of the Western United States, that such lower lines are well marked; but when they are in control they are both strongly pronounced and often of decided economic importance. A convenient method of designating them, therefore, seems a desideratum. Dr. Merriam considered that the lower limit is often determined by temperature rather than by aridity, and Prof. Russell would in this case employ "hot timberline," though he does not admit that any of the various factors is of the same importance in limiting the downward advance of forests as dearth of soil-moisture. In the case of the upper line various factors again come into play, but as here the most common and dominant cause is a low mean annual temperature, the designation "cold timberline" is the most suitable, and in a similar manner the use of the term "wet timberline" might be justified.

GENERAL.

The Postal Union and the Commerce of the World.—In an address delivered before the Gesellschaft für Erdkunde und Kolonialwesen in Strasburg on April 24, 1903, Herr J. Jung contrasted the condition of the postal service years ago, and since the establishment of the postal union. Before 1874 each country had its own regulations regarding foreign letters, and the exchange of letters with foreign countries, rates for through transit, and other matters, were arranged by a multitude of treaties. In Germany the intricacies of the postal system were peculiarly great. In Hamburg, for instance, there were post-offices for Prussia, Hanover, Thurn and Taxis, and Denmark. By the postal congress held at Bern on September 15, 1874, a postal union was formed, to which twenty-two states containing 350 million inhabitants gave their adhesion. Free transit was established through all the participating states, except along certain much-frequented routes, a uniform weight limit and postage rate was fixed, and the system of dividing the postage between the countries a letter passed through was abolished, as it was found

that on the whole the services rendered and received were about equal. Since its establishment the union has been joined by other states, and now extends over 40 million square miles peopled by 1100 million persons. Whereas in 1873 the number of letters, postcards, packages, etc., sent through the post in these states numbered 3300 millions, in the year 1900 the number had risen to more than 29,000 millions, or about 80 millions daily. The chief items were—letters, 11,000; postcards, 3300; printed matter and samples, 14,000 millions; and the routes by which mails were despatched had an aggregate length of 1864 million miles, or more than twenty times the distance of the Earth from the Sun. The share of Great Britain in this correspondence is probably not less than 500 million postal despatches (no figures are published); Germany sends 245, Austria-Hungary 236, and France 233 millions. Herr Jung also spoke of the development of steam navigation in connection with foreign mails, and compared the increase of postal despatches with that of the commerce of various countries. Perhaps he gives rather too much credit to the postal service for the development of trade. It should rather be said that international commerce rendered the postal union necessary.

A Chinese Map of the World.—Dr. Ahlenius, in a publication of the Humanistika Vetenskaps-Samfund at Upsala, describes a map of the world in the University library. It was compiled by the well-known Belgian Jesuit, Ferdinand Verbiest, and bears his Chinese name, Nan-Hoei-Gin, and that of the Emperor Kang-Hsi (1661–1722), by whom he was appointed director of the Astronomical Academy in Pekin. Verbiest had exceptional opportunities of acquiring information about the Chinese Empire, for he accompanied the emperor on his journeys into Manchuria and Mongolia. His map is drawn on the stereographic projection, the degrees on the equator being marked eastwards only, and not east and west, from the first meridian through Pekin. The material seems to have been taken from Mercator, Ortelius, Thevenot, Sanson, Blaeu, and other cartographers. China, Manchuria, Mongolia, and Central Asia are laid down from Verbiest's own observations and investigations. The Amur flows into the Fretum Anian, the mythical strait between Asia and America. It is singular that New Zealand is represented as an island, though it was proved to be so only in 1769, by Cook. The nomenclature was apparently put first in a Latin form, and then transliterated into Chinese. There are copies of this map in Paris and in the British Museum (dated 1669?). A reproduction accompanies the paper.

Centenary of the Bombay Branch of the Royal Asiatic Society.—In January, 1905, the Bombay branch of the Royal Asiatic Society proposes to celebrate the centenary of its foundation by a public gathering, at which papers will be read by distinguished scholars, and an exhibition of the possessions of the Society held, together with public entertainments. The celebration will commence on January 17. At its first institution, under the presidency of Sir James Mackintosh, the Society was known as the "Bombay Literary Society," but this was afterwards affiliated to the Royal Asiatic Society.

Fourteenth International Congress of Americanists.—The fourteenth meeting of this Congress will take place this year at Stuttgart, August 18 to August 23. The general programme has been arranged by a Committee of Organization, under the presidency of Dr. Karl von den Steinen, and the subjects to be discussed will be (*a*) The native races of America—their origin, distribution, physical characteristics, etc., etc.; (*b*) the monuments and archæology of America; (*c*) the history of the discovery and occupation of the New World. Communications, the titles of which should be sent to the General Secretary, Dr. K. Lampert, 13, Archivstrasse, Stuttgart, as soon as possible, may be oral or written, and in English, German, French, Italian, or Spanish. Abstracts of papers accepted,

limited to a thousand words, should be sent in before July 1. Membership is acquired by the payment of 12 marks; while Associates (who have not the right to vote or to receive the publications gratuitously) will pay 4 marks.

International Congress of Orientalists.—This Congress will hold its fourteenth session at Easter, 1905, at Algiers, this being the first occasion on which it will have met in Algeria. The organizing committee is presided over by the well-known Orientalist, Prof. R. Basset, and in the circular already issued it is announced that particular, though not exclusive, attention will be given to questions concerning North Africa and the Mohammedan world. In addition to linguistic studies, the subjects which may be dealt with include the history, religion, folklore, ethnography, etc., of Eastern peoples, as well as the geography of the East.

Vacation Course at Oxford.—A vacation course, similar to that so successfully inaugurated at Oxford two years ago, will be held this year in connection with the School of Geography between August 2 and 16 inclusive. It will consist of lectures, demonstrations, field-work, and excursions, conducted by the staff of the school, and is intended primarily for teachers, though open also to others. The fee for the whole course will be £3 3s., and names of intending students should be sent as soon as possible to the curator.

OBITUARY.

Eli Sowerbutts.

We regret to have to record the death of Mr. Eli Sowerbutts, who had been a Fellow of the Royal Geographical Society since 1887. In 1884 he was the founder of the Manchester Geographical Society, and gave to it his untiring services as secretary with disinterested zeal until his decease. Mr. Sowerbutts was born in Chorley on May 27, 1834, but very early removed to Manchester, and began life in the printing office of Mr. Love. He took advantage of the classes connected with the Mechanics' Institution, and subsequently of the Working Men's College, to improve his education. He spent some time, when his apprenticeship was finished, in a London engraver's office, and afterwards established a business in Huddersfield on his own account. The business was not successful, and he returned to Manchester, where he became an accountant, a profession which he continued till he devoted himself altogether to the service of geography. He was faithful to his early political principles, and took an active part in the advocacy of reform, both in national and municipal affairs. But it was late in the seventies that he found his true vocation. He had been long interested in geographical work, and perceived how valuable would be its application to the commercial interests of his country. He saw how its study was neglected in every stage of education from the Elementary School to the University, and strove to arouse in others the enthusiasm for it which he felt himself. Influenced by him, Cardinal Vaughan, then Bishop of Salford, assisted by the Bishop of Manchester, some of the Professors of Owens College, the chairman and some of the directors of the Chamber of Commerce, tried to establish a geographical society in Manchester in 1879, but failed in securing support. Mr. Sowerbutts continued the work, and at last, in 1884, his perseverance was crowned with success, and on the 15th October, 1884, the Manchester Geographical Society was established. Since then with never-failing zeal Mr. Sowerbutts gave himself entirely to its service. It was he who secured for exhibition in Manchester part of the valuable collection of models, maps, and other educational

appliances, collected by Dr. Scott Keltie, on behalf of the Royal Geographical Society, as commissioner, inquiring into the subject of geographical education, together with loans from several publishers and private collectors. Fifteen addresses were given by specialists during the month the exhibition was open, and Mr. Sowerbutts gave an address to the visitors every day in explanation of the exhibits. These lectures aroused much interest in the district near Manchester, and Mr. Sowerbutts was invited to address audiences on geographical subjects in many neighbouring towns, until the applications became more numerous than could be met by any one person. Mr. Sowerbutts had inspired several members of the Society with something of his own devotion, and they volunteered to help, forming an inner circle of membership, which, as it began in the Jubilee year (1887), was called "The Victorians." The members of this band of workers have, since their organization, delivered about 1000 popular lectures, mostly illustrated with limelight views, maps, and diagrams, in most cases specially drawn. Under Mr. Sowerbutts' guidance for six years they prepared an annual analysis of the principal geographical journals which had been added to the Society's library, and as these were about 250, it was for that period a valuable addition to the *Journal*. It is impossible to exaggerate the amount of time and labour which Mr. Sowerbutts gave to the Society; he was constantly at the rooms, ever ready to give information to callers; he was in correspondence with societies all over the world; he arranged the regular meetings, securing the services of travellers and explorers; he edited the *Journal*, and prepared himself to deliver addresses which never failed to interest and instruct his audiences. His genial spirit, his extensive knowledge, his sympathy with every inquirer, secured for him a large number of friends, and made the Society's rooms an attractive meeting-place; and it will be a difficult task to find any one with gifts like his to occupy his vacant office. All who were privileged to claim him as a friend will miss his straightforward, manly companionship, and will cherish the memory of the loving tenderness which, with a somewhat rough exterior, has endeared him to a wide circle of affectionate companions.

Deputy-Surgeon General Henry Cayley, C.M.G., I.M.S., Honorary Surgeon to the King.

The death is announced of Dr. Cayley, who had been a Fellow of our Society since 1869. His connection with Geography came about in this way: In 1865, Lord Lawrence, averse to all forward policy, yielded so far in the case of Ladak as to say, "You may send a doctor; he can do no harm;" so Cayley was sent as first Resident to Lé. During the five years 1866–70 he remained in Ladak, Cayley carried out much geographical work, corrected much of the topography, kept careful meteorological registers, and established the fact that in Tibet, at 12,000 feet above the sea, water may be made to boil by the direct action of the sun's rays, which raises the sun thermometer to over 212° Fahr. (see p. 2, 'Blanford's Climates of India and Burmah,' 1889); he thoroughly explored nearly the whole of Ladak, and did much to improve the trade routes. Lord Mayo, at a public dinner at Lahore in 1870, said that Cayley had done more than any man to foster trade and create good relations between India and Central Asia. It was Cayley's work which led to Shaw's visit to Yarkand in 1888–89, and to the two Forsyth expeditions to Yarkand, one in 1870, the other in 1873; these burst the Central Asian bubble, and showed what even now many people do not realize—that Central Asia is more or less a Sahara, and the 500 miles between it and India still more of a Sahara, being 10,000 to 15,000 feet above sea-level, and quite impassable for even a small army. Cayley never got any substantial recognition of his services in Ladak, beyond

flattering words in official documents. It was only after serving at Netley, as Professor of Military Medicine, that he got a C.M.G., and was made Honorary Surgeon to the King. Cayley was devoted to his profession, had great business capacity, tact, and energy. He was a man of most amiable disposition, and was greatly loved and respected by all who knew him. His death occurred at Leavesden, Weybridge, on March 19, in his seventieth year.

G. H.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1903-1904.

Eleventh Ordinary Meeting, April 25, 1904.—Colonel Sir T. H. Holdich, R.E., K.C.I.E., C.B., Vice-President, in the Chair.

Elections.—*Josiah Baker; John Byng Banks; Roland Burdon; W. George Davies, R.H.G.; Isidore Goetz; H. Hallam Hardy (R.A. Medical Corps); Captain Hugh Hill (Royal Welsh Fusiliers); Wilfred Matheson; Major Walter Simeon Nathan, R.E.; Colonel Don Pedro Suarez; Captain Harry Stanley Toppin, Northumberland Fusiliers; Dudley West.*

The paper read was:—

"The German Antarctic Expedition." By Dr. Eric von Drygalski.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Cartography. *Z. Deuts. u. Oesterr. Alpenv.* **34** (1903): 32-41. **Oberhummer.**
Die Entwicklung der Alpenkarten im 19. Jahrhundert. Von Eugen Oberhummer. ii. Teil. Oesterreich. *Maps.*

Alps—Soiernsee. *W. Veröffentlichungen V. Erdk. Leipzig* **6** (1904): 211-316. **März.**
Der Seenkessel der Soiern, ein Karwendelkar. Von Dr. Christian März. *Map and Illustrations.*

Alps—Vegetation. **Reishauer.**
W. Veröff. entlichungen V. Erdk. Leipzig **6** (1904): 1–210.
Höhengrenzen der Vegetation in den Stubaier Alpen und in der Adamellogruppe. Von Hermann Reishauer. *Illustrations.*

Austria—Hallstätter See. *M.K.K.G. Ges.* **46** (1903): 316–322. **Lorenz-Liburnau.**
Retrospektives ueber Karten des Hallstätter Sees. Von Sektionschef Dr. J. R. Ritter v. Lorenz-Liburnau.

Austria—Tyrol. *Z. Deuts. u. Oesterr. Alpenv.* **34** (1903): 1–31. **Frech.**
Ueber das Antlitz der Tiroler Zentralalpen. Von Fritz Frech. *Map and Illustrations.*

Balkan States. **Wyon.**
The Balkans from Within. By Reginald Wyon. London: J. Finch & Co., 1904. Size 9 × 6, pp. xviii. and 476. *Map and Illustrations. Price* 15*s. net. Presented by the Publishers.* [To be reviewed.]

Belgium. **Jonckheere.**
L'origine de la Côte de Flandre et le Bateau de Bruges (suivi de deux annexes, de huit planches et d'un appendice). Par E. Jonckheere. Bruges, 1903. Size 10 × 6½, pp. 76, 34, and 10. *Maps and Plates (separate). Presented by the Author.*

Denmark.
Den Danske Turistforenings Aarsskrift 1904. København: G. E. C. Gad, 1904. Size 9 × 6, pp. 104 and xxxvi. *Illustrations. Presented by E. L. Salomonsen & Co.*

Europe—Limnology. **Pettersson.**
Bihang till K. Svenska Vet.-A. Handlingar **28**, Afdel. ii. (1903): No. 2, pp. 18.
Resultaten af den internationella undersökningen af Norra Europas djupa sjöar och innanhaf år 1900. Semmanställda af O. Pettersson.
Records observations from the Lake of Geneva, Loch Katrine, Ladoga, various Swedish lakes, etc.

France—Ain. *La G., B.S.G. Paris* **8** (1903): 341–356. **Bois.**
Le Pont des Oulles, phénomène d'érosion par les eaux courantes (Bellegarde, Ain). Par É. Chaix Du Bois. *With Illustrations.*

France—Basses Pyrénées. **Buffault.**
B.S.G. Com. Bordeaux **29** (1903): 341–356, 361–371, 381–385; **30** (1904): 3–16, 33–40, 93–102.
Forêts et Gaves du pays d'Aspe. Par P. Buffault. *With Map and Illustrations.*

France—Cartography. *M.K.K.G. Ges.* **46** (1903): 292–315. **Wagner.**
Bemerkungen zu W. Stavenhagens Aufsatz "Frankreichs Kartenwesen in geschichtlicher Entwicklung." Von Hermann Wagner.

France—Corsica. *Z. Deuts. u. Oesterr. Alpenv.* **34** (1903): 148–173. **v. Cube.**
Hochtouren auf Korsika. Von Dr. Felix von Cube. *Maps and Illustrations.*

Germany—Prussia. *Petermanns M.* **49** (1903): 265–266. **Braun.**
Der Okull-See im südlichen Ostpreussen. Von Dr. G. Braun. *With Map.*

Germany—Rhine. *M.G. Ges. Hamburg* **19** (1903): 217–241. **Michow.**
Caspar Vopell u. seine Rheinkarte vom Jahre 1558. Von H. Michow. *Map.*

Germany—Röm. *M.G. Ges. Hamburg* **19** (1903): 1–210. **Moritz.**
Die Nordseeinsel Röm. Von Eduard Moritz. *Maps.*

Germany—Swabia. **Schulz.**
Die Entwickelungsgeschichte der gegenwärtigen Phanerogamen-Flora und Pflanzendecke der Schwäbischen Alb. Von A. Schulz. (Separat-Abdruck aus Engler's Botanischen Jahrbüchern, 32 Band, 4–5 Heft, 1903.) Leipzig: W. Engelmann. Size 9 × 6½, pp. 633–661.

Germany and Austria. *Z. Deuts. u. Oesterr. Alpenv.* **34** (1903): 95–113. **Waltenberger.**
Die Revision der Landesgrenze zwischen Bayern und Tirol im Karwendel- u. Wettersteingebirge. Von E. Waltenberger. *Map and Illustrations.*

Holland—Linde. *Tijds. K. Nederl. Aardr. Genoots.* **21** (1904): 46–64. **Veeren**
De Rivier "De Linde" en haar Stroomgebied boven de Oldeberkoopster Draaibrug. Door F. E. L. Veeren.

Holland—Settlements. *Tijds. K. Nederl. Aardr. Genoots.* **21** (1904): 1–45. **Blink.**
Studiën over Nederzettingen in Nederland. Door Dr. H. Blink.
Continued from vol. xix. (cf. *Journal*, vol. xxi. p. 75).

Holland—Valley-forms. **van Baren.**
Tijds. K. Nederl. Aardr. Genoots. **21** (1904): 137–138.
Asymmetrische Erosiedalen op de Veluwe. Door J. van Baren.

Iceland.
Mímir. Icelandic Institutions with Addresses. Copenhague, 1903. Size 6 × 4¼, pp. vii. and 80.
Contains also "Notes on Icelandic Matters."

Italy—Historical. *Archæologia* **58** (1903): 499–560. **Günther.**
The Submerged Greek and Roman Foreshore near Naples. By R. T. Günther. *With Maps and Illustrations.*

Italy—Rome. **Ellaby.**
Rome. By C. G. Ellaby. Illustrated by B. C. Boulter. London: Methuen & Co., 1904. Size 6½ × 4, pp. viii. and 300. *Plans and Illustrations. Price* 3*s. Presented by the Publishers.*
Intended not as an elaborate guide-book, but rather as a help to the student on his first visit to Rome. The general plan is to describe the architectural remains, etc., according to their character and date.

Italy—Venice. **Pauli.**
Venice. By Gustav Pauli. Translated by P. G. Konody. London: H. Grevel & Co., 1904. Size 10 × 7, pp. 174. *Illustrations. Price* 4*s. net. Presented by the Publishers.*
Largely descriptive of the art treasures of Venice.

Mediterranean. **Philippson.**
Das Mittelmeergebiet, seine geographische und Kulturelle Eigenart. Von A. Philippson. Leipzig: B. G. Teubner, 1904. Size 9½ × 6½, pp. viii. and 266. *Maps and Illustrations. Price* 6 *m. Presented by the Publisher.*
To be reviewed.

Norway—Christiania. **Amnéus.**
B.S.G. Com. Bordeaux **27** (1901): 293, 333; **28** (1902): 149, 285, 304, 361; **29** (1903): 1, 85, 205, 247, 329, 372; **30** (1904): 40.
La Ville de Kristiania, son Commerce, sa Navigation et son Industrie. Par G. Amnéus. *With Illustrations.*

Norway—Lofoten. *Alpine J.* **22** (1904): 3–15. **Collie.**
Lofoten. By J. Norman Collie. *With Illustrations.*

Rumania. *C. Rd.* (1903): 1009–1011. **Bergeron.**
Observations relatives à la tectonique de la haute vallée de la Jalornita (Roumanie). Par J. Bergeron.

Sweden and Norway—Railway. *Rev. G.* **54** (1903): 1–8. **Vinci.**
L' "Express-Lapon." Par V. Gaudard de Vinci. *With Map and Illustrations.*

Switzerland—Geology. **Kissling.**
Beiträge zur Geologie der Schweiz, Geotechnische Serie, ii. Lieferung. Die Schweizerischen Molassekohlen westlich der Reuss. Von Dr. Ernst Kissling. Bern, 1903. Size 12 × 9, pp. 76. *Maps and Sections.*

Turkey—Macedonia. *Tour du Monde* **10** (1904): 1–36. **Malet.**
En Macédoine. Au vilayet de Monastir. Par M. Albert Malet. *Illustrations.*

United Kingdom—Bird Migration. *Nature* **69** (1904): 516. **Clarke.**
Bird Migration in Great Britain and Ireland. By W. E. Clarke.

United Kingdom—Geological Survey. **Jukes-Browne and Hill.**
Memoirs of the Geological Survey of the United Kingdom. The Cretaceous Rocks of Britain. Vol. i. The Gault and Upper Greensand of England, by A. J. Jukes-Browne, with contributions by William Hill (pp. xiv. and 500).—Vol. ii. The Lower and Middle Chalk of England, by the same (pp. xiii. and 568).—Vol. iii. The Upper Chalk of England, by the same (pp. x. and 566). London: Eyre & Spottiswoode and E. Stanford, 1900–1904. Size 10½ × 6½. *Maps and Illustrations. Price,* (vol. i.) 9*s.*; (vol. ii.) 10*s.*; (vol. iii.) 10*s. Presented by the Geological Survey.*

United Kingdom—Historical. **Thompson.**
Chronicon Adæ de Usk, A.D. 1377–1421. Edited with a Translation and Notes

by Sir E. M. Thompson, K.C.B. Second Edition. London: H. Frowde, 1904. Size 10 × 6½, pp. xxxviii. and 346. *Presented by the Royal Society of Literature.*

The first edition appeared in 1876, but the text could not then be completed owing to the imperfection of the manuscript. The missing portion has since been discovered among a number of neglected documents in a loft at Belvoir Castle.

United Kingdom—Scotland. **Watt.**

The Altitude of Forest Trees on the Cairngorm Mountains. By H. B. Watt. (Reprinted from *Cairngorm Club Journal*, vol. iv. No. 20, January, 1903. Aberdeen.) Size 9 × 5½, pp. [4]. *Presented by the Author.*

See note in *Journal*, vol. xxi. p. 316.

United Kingdom—Trade. **Cunningham.**

The Growth of English Industry and Commerce in Modern Times. Two Parts. By W. Cunningham, D.D. Cambridge: The University Press, 1903. Size 9 × 6, pp. xxxviii. and 1040. *Price, Parts I. and II., 25s. net.*

In this, the third edition, Dr. Cunningham's well-known work has been entirely recast and in great measure re-written.

ASIA.

Afghanistan. *J.S. Arts* **52** (1904): 347–360. **Holdich.**

Our Commercial Relations with Afghanistan. By Colonel Sir T. H. Holdich. *With Map.*

Arabia. **Hogarth.**

The Penetration of Arabia. A Record of the Development of Western Knowledge concerning the Arabian Peninsula. By D. G. Hogarth. London: Lawrence & Bullen, 1904. Size 9½ × 6, pp. xvi. and 360. *Maps, Plans, and Illustrations. Price 7s. 6d. Presented by the Publishers.* [To be reviewed.]

Ceylon. *J.R. Colonial I.* **35** (1904): 213–252. **Ferguson.**

Ceylon from 1896 to 1903. By John Ferguson.

China. *La G., B.S.G. Paris* **9** (1904): 7–23. **François.**

Le Liéou-Kiang et la rivière de King-Yuan-Fou (Kouang-si). Par A. François. *With Maps.*

See note in April *Journal* (p. 518).

China and India—Early travel. **Chavannes.**

B. L'Ecole Franç. Extrême-Orient **3** (1903): 379–441.

Voyage de Song Yun dans L'Udyāna et la Gandhāra (518–522 p. C.). Traduit par M. E. Chavannes.

Chinese Empire—Tibet. **Das.**

Journey to Lhasa and Central Tibet. By Sarat Chandra Das. Edited by the Hon. W. W. Rockhill. New Edition. London: John Murray, 1904. Size 9 × 6, pp. xvi. and 368. *Map and Illustrations. Price 10s. 6d. net. Presented by the Publisher.*

Reprint of the narrative originally issued by the R.G.S.

Chinese Empire—Tibet. *La G., B.S.G. Paris* **9** (1904): 24–29. **Deniker.**

Voyage de M. Tsybikov à Lhassa et au Tibet. Par J. Deniker.

Cf. *Journal* for January (*ante*, p. 92).

Chinese Empire—Tibet. *Alpine J.* **22** (1904): 56–59. **Freshfield.**

Notes from Tibet. By D. W. Freshfield.

Chinese Empire—Tibet. ——

East India (Tibet). Papers relating to Tibet. London: Eyre & Spottiswoode, 1904. Size 13 × 8½, pp. x. and 314. *Map. Price 3s. 1d.*

French Indo-China—Laos. *La G., B.S.G. Paris* **9** (1904): 63–65. **Bernard.**

Trois ans au Laos.—Le plateau des Boloven. Par M. le Docteur Bernard.

India—Burma. *Rev. G.* **53** (1903): 511–524. **Gonnaud.**

Aperçus sur la Birmanie. Le Pays, les Habitants, les voies de Communication, la Politique Anglaise. Par P. Gonnaud.

India—Burma. *Petermanns M.* **49** (1903): 267–268. **Schlagintweit.**

Englands Grenzen in Birma. Von Dr. E. Schlagintweit. *With Map.*

Describes the results of recent delimitations.

India—Kashmir. *Alpine J.* **22** (1904): 16–20. **Workman.**

Ascent of the Bhayakara La, Baltistan. By Dr. W. H. Workman. *With Illustration.*

Java—Maps and Plans. **Bosboom.**

Notulen Bataviaasch Genoots. Kunsten en Wetensch. **40** (1902): lxiii.–lxxii.

Opgave van verzonden Calques en reproducties naar Karten en platte-gronden aanwezig in het rijksarchief te 's Gravenhage.

Japan. *M. Deutsch. Ges. Natur- u. Völkerk. Ostasiens* **9** (1903): 331–341. **Haas.**

Ursprung des Namens Nippon. Von P. H. Haas.

Japan. **Hartshorne.**

Japan and her People. By Anna C. Hartshorne. Two vols. London: Kegan Paul & Co., 1904. Size 8½ × 5½, pp. (vol. i.) x. and 378; (vol. ii.) vi. and 374. *Map and Illustrations. Price* 21*s.*

Japan. **Koch.**

Japan. Geschichte nach japanischen Quellen und Ethnographische Skizzen. Von W. Koch. Dresden: W. Baensch, 1904. Size 9 × 6, pp. vi. and 410. *Price* 7*s.*

Japan. *Deutsch. Ges. Natur- u. Völkerk. Ostasiens* **9** (1903): 297–329. **Koganei.**

Ueber die Urbewohner von Japan. Von Dr. Y. Koganei.

Japan. **Davidson.**

Present-day Japan. By A. M. Campbell Davidson. London: T. Fisher Unwin, 1904. Size 9½ × 6, pp. xiv. and 332. *Illustrations. Price* 21*s. Presented by the Publisher.*

Japan—Earth-movements. *Petermanns M.* **49** (1903): 284–285. **Hammer.**

Bodenhebungen und -senkungen in Japan. Von Prof. Dr. E. Hammer.

Japan—Formosa. **Plant.**

M. Seminars Orient. Sprachen Berlin VI. (1903): 1 Abt.; 28–62.

Beiträge zur Kenntniss der Insel Formosa. Von Hermann Plant.

Deals with the history of Formosa, and of the manners and customs of its people.

Korea. **Hamilton.**

Korea. By Angus Hamilton. London: W. Heinemann, 1904. Size 9 × 6, pp. xlii. and 316. *Map and Illustrations. Price* 15*s. net.*

The most detailed and trustworthy of recent descriptions of Korea.

Malay Archipelago—Engano. **Winkler.**

Tijds. Indische Taal-, Land- en Volkenkunde **46** (1903): 558–567.

Bericht über die Untersuchungsreise nach der Insel Engano; 4–11 Apr. 1903. Von Dr. Johan Winkler.

Malay Archipelago—Simalur. **Westenenk.**

Tijds. K. Nederl. Aardr. Genoots. **21** (1904): 65–87.

Simaloer. Bijdrage tot de Kennis van dit Eiland. Door L. C. Westenenk. *Map.*

Simalur, or is one Simalu, of the islands off the west coast of Sumatra.

Manchuria and Korea. **Whigham.**

Manchuria and Korea. By H. J. Whigham. London: Isbister & Co., 1904. Size 9½ × 6, pp. 246. *Map and Illustrations. Price* 7*s.* 6*d. Presented by the Publishers.*

See Review, *ante*, p. 773.

Pamirs—Meteorology. **Hjuler.**

Second Danish Pamir Expedition conducted by O. Olufsen. Meesurements of Electric Tension of the Air. By A. Hjuler. Det Nordiske Vorlag, 1903. Size 10 × 7, pp. 25. *Presented by Lieut. O. Olufsen.*

Russia—Caucasus. *Naturwissens. Wochenschrift* **19** (1904): 246–250. **Rossmässler.**

Naturschilderung aus dem südlichen Kaukasus. Von F. Rossmässler.

Russia—Kamchatka. **Demidoff.**

A Shooting Trip to Kamchatka. By E. Demidoff, Prince San Donato. London: Rowland Ward, 1904. Size 9½ × 6½, pp. xvi. and 302. *Map and Illustrations. Price* 21*s. net. Presented by the Author.*

The trip here described was made in 1900.

Russia—Siberia—Altai. *Alpine J.* **22** (1904): 42–56 **Turner.**

Winter Exploration in the Altai, South Central Siberia. By S. Turner. *With Illustrations.*

See note in the Monthly Record for May.

Russia—Siberia—Geology. ———

Explorations Géologiques dans Les Régions Aurifères de la Sibérie. Région Aurifère de Léna. Livr. ii. Ditto, d'Iénisséi, Livr. iv. [Russian, *Résumé* in French.] St. Petersburg, 1903. Size 10 × 6½, pp. 81, 80. *Maps.*

Russia—Siberia—Population. **Patkanov.**

Institut International de Statistique. Essai d'une Statistique et d'une Géographie des Peuples Palæasiatiques de la Sibérie d'après les données du recensement de 1897. Par S. Patkanov. St. Petersburg, 1903. Size 10½ × 7½. *Presented by the Author.*

Turkey—Asia Minor and Syria. **Fitzner.**

Aus Kleinasien und Syrien. Von Dr. Rudolf Fitzner. Band i. Rostock: C. J. E. Volckmann (Volckmann & Wette), 1904. Size 10 × 6½, pp. x. and 238. *Maps and Illustrations. Price 5s.*

Contains a chapter on the Baghdad railway.

Turkey—Palestine—Dead Sea. **Ackroyd.**

Palestine Expl. Fund Quart. Statem. (1904): 64–66.

On a Principal Cause of the Saltness of the Dead Sea. By William Ackroyd.

The cause referred to is the atmospheric transport of the salt of the Mediterranean by wind and rain.

Turkey—Palestine—Dead Sea. **Masterman.**

Palestine Expl. Fund Quart. Statem. (1904): 83–95.

Observations on the Dead Sea Level. By Dr. E. W. Gurney Masterman. Second Report, 1902–1903.

AFRICA.

Africa—Astronomical Observations. *Rev. Coloniale* **15** (1903): 263–277. **Roche.**

Méthode à suivre pour les Observations Astronomiques à exécuter en Afrique. Par M. le Capitaine Roche.

Cape Colony—Gouritz River. *T.S. African Philos. S.* **14** (1903): 375–384. **Rogers.**

The Geological History of the Gouritz River System. By A. W. Rogers. *With Plate.*

Noticed in the Monthly Record for May (p. 687).

Central Africa—Vegetation. **Wildeman.**

Missions Belges **5** (1903): 193–199, 233–240, 280–291, 307–322.

La végétation de l'Afrique tropicale Centrale. Par É. De Wildeman. *With Illustrations.*

Congo State—Pygmies. *Globus* **85** (1904): 117–119. **Davids.**

Ueber die Pygmäen am oberen Ituri. Aus einem Briefe Dr. J. Davids.

Dahomé—Borgu. *La G., B.S.G. Paris* **9** (1904): 155–158. **Brousseau.**

Le Borgou (Haut-Dahomey). Par M. Brousseau. *With Map.*

Egypt. *B.S. Khédiviale G.* **6** (1903): 103–109. **Paoletti.**

La Route d'El Kantara à El Arich et Rafaa. Note de M. A. H. Paoletti. *Map.*

Egyptian Sudan. ———

Sudan Almanac, 1904. London, 1904. Size 6 × 4½, pp. 51. *Presented by the Director of Intelligence, Cairo.*

Egyptian Sudan—Shilluks. *B.S. Khédiv. G.* **6** (1903): 111–141. **Tappi.**

Notes Ethnologiques sur les Chillouks. Par le R. P. C. Tappi. (Traduits de l'italien.) *With Illustrations.*

French Guinea. *Rev. G.* **54** (1904): 17–23. **Normand.**

Notes hydrographiques sur la Guinée française. Par Capitaine R. Normand. *With Map and Illustrations.*

Ivory Coast—Kavally. **Repiquet.**

Renseign. Colon. Com. l'Afrique Franç. **13** (1903): 277–292.

Le Bas Cavally français. Par M. Jules Repiquet.

Morocco. **Dawson.**

Things seen in Morocco. Being a bundle of jottings, notes, impressions, tales, and

tributes. By A. J. Dawson. London: Methuen & Co., 1904. Size 9 × 6, pp. xii. and 354. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Nigeria. *J.S. Arts.* **52** (1904): 370–384. **Lugard.**

Nigeria. By Lady Lugard. *With Map.*

Nigeria—Hausa States. **Mischlich and Lippert.**

M. Seminars Orient. Sprachen Berlin **6** (1903): 3 Abt., 137–242.

Beiträge zur Geschichte der Haussastaaten. Von A. Mischlich. Mit Einleitung von Julius Lippert. *Map.*

Somaliland. *B.S.G. Italiana* **5** (1904): 8–13. **Gestro.**

Collezioni zoologiche del tenente Citerni in Somalia. Cenni del dott. R. Gestro. *With Illustrations.*

South Africa. **Cumming.**

The Lion Hunter of South Africa. Five Years' Adventures in the Far Interior of South Africa, with Notices of the Native Tribes and Savage Animals. By R. Gordon Cumming. A New Edition. London: John Murray, 1904. Size 8½ × 5½, pp. xii. and 498. *Illustrations. Price* 2*s.* 6*d. net. Presented by the Publisher.*

The eighth edition of this well-known book, which originally appeared in 1850.

South Africa—Native Tribes. **Kidd.**

The Essential Kaffir. By Dudley Kidd. London: A. & C. Black, 1904. Size 9 × 6½, pp. xvi. and 436. *Maps and Illustrations. Price* 18*s. net. Presented by the Publishers.*

Vivid sketches of native life and character in South Africa.

Uganda. **Mullins.**

The Wonderful Story of Uganda. By the Rev. J. D. Mullins. To which is added the Story of Ham Mukasa, told by himself. London: Church Missionary Society, 1904. Size 7½ × 5, pp. xii. and 224. *Map and Illustrations. Price* 1*s.* 6*d. net. Presented by the Church Missionary Society.*

NORTH AMERICA.

Alaska—Boundary. ——

Correspondence respecting the Alaska Boundary. With Map. (United States, Nos. 1 and 2, [1904].) London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. iv. and 88. *Price* 9*d.*; *Map*, 6*d.*

Alaska—Glaciers. **Gilbert.**

Harriman Alaska Expedition with co-operation of Washington Academy of Sciences. Alaska. Vol. iii.—Glaciers and Glaciation. By G. K. Gilbert. New York: Doubleday, Page & Co., 1904. Size 10½ × 7½, pp. xii. and 232. *Maps and Illustrations. Presented by the Publishers.*

America—Discovery. *Rev. Trimensal I. Ceará* **17** (1903): 5–32. **Teschauer.**

Sera discutivel a prioridade dos Portuguezes no descobrimento da America? Pelo Rod. P. Carlos Teschauer, S.J.

Canada. **Hanbury.**

Sport and Travel in the Northland of Canada. By David T. Hanbury. London: Edward Arnold, 1904. Size 9 × 6, pp. xxxii. and 320. *Maps and Illustrations. Price* 16*s. net. Presented by the Author.* [To be reviewed.]

Canada. *J. Geology* **11** (1903): 615–669. **Wilson.**

The Laurentian Peneplain. By A. W. G. Wilson. *With Maps and Illustrations.*

Canada—Ethnography. *P. and T.R.S. Canada* **8** (1902): Sec. 1, 15–23. **Le Moine.**

Etude Ethnographique des Éléments qui constituent la population du Canada—Origine de la population Canadienne. Par Sir James M'Pherson Le Moine.

Canada—Survey. **Hills.**

Report on the Survey of Canada. By Major E. H. Hills, C.M.G. Size 13 × 8½, pp. 32. *Maps. Presented by the Author.*

Niagara. *Nature* **69** (1904): 499. ——

Frost effects at Niagara. *With Illustrations.*

North America—Ports. **Rochemont and Vétillart.**

Les ports maritimes de l'Amérique du Nord sur l'Atlantique, par le Baron Quinette de Rochemont et H. Vétillart. I. Les Ports Canadiens (with Atlas). II.

Régime administratif des voies navigables et des ports aux Etats-Unis. III. Les Ports des États-Unis (with atlas). Paris: V. C. Dunod, 1898–1904. Size 9½ × 6½, atlases 22 × 15, pp. (vol. i.) 241; (vol. ii.) 589; (vol. iii.) 608. *Maps and Plans separate. Price £2 15s.*

A valuable work giving full details as to the development and present position of the ports.

United States—California—Mount Whitney. **McAdie and Heiskell.**
Monthly Weather Rev. **31** (1903): 524–527.

Mount Whitney as a site for a Meteorological Observatory, by Alexander G. McAdie. Computation of the altitude of Mount Whitney, by H. L. Heiskell.

Mr. J. N. Le Conte's and Prof. McAdie's observations, taken on July 8, 1903, give a height of 14,515 feet for Mr. Whitney, in the place of the usual estimate of 14,900 feet. Mr. Heiskell thinks the observations were not such as to give very accurate results, but places the height still lower.

United States—Census. **Dewey.**

Twelfth Census of the United States, taken in the year 1900. Special Reports. Employees and Wages, by D. R. Dewey, PH.D. Washington, 1903. Size 12 × 9½, pp. cxvi. and 1228.

United States—Massachusetts. **Tarr and Woodworth.**
B. Museum Comparative Zoology **42** (1903): 181–196.

Postglacial and Interglacial (?) Changes of Level at Cape Ann, Massachusetts. By R. S. Tarr. With a Note on the Elevated Beaches by J. B. Woodworth. *With Map and Plate*

United States—New Mexico. *B. American G.S.* **35** (1903): 472–475. **Duff.**

The City of Rocks. By U. F. Duff. *With Illustrations.*

On a ridge of rocks in southern New Mexico weathered into shapes recalling those of a city.

United States—New York. *J. Geology* **11** (1903): 670–678. **Mills.**

River Terraces and Reversed Drainage. By F. S. Mills. *With Illustrations.*

United States—Sierra Nevada. *Sierra Club B.* **5** (1904): 20–25. **Gilbert.**

Variations of Sierra Glaciers. By G. K. Gilbert. *With Illustrations.*

United States—Surveys. *B. American G.S.* **36** (1904): 29–36. ———

Notes on Geological Surveys.

United States—Utah. **Huntington and Goldthwait.**
B. Mus. Comp. Zoology **42** (1904): 201–259.

The Hurricane Fault in the Toquerville District, Utah. By Ellsworth Huntington and James Walter Goldthwait. *Plates.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *B. American G.S.* **35** (1903): 439–471. **Corthell.**

Two Years in Argentine as the Consulting Engineer of National Public Works. A Lecture by E. L. Corthell.

Argentine Republic. ———

Proyecto de Canal de Navegación de Mar Chiquita (Junin) al Rio Baradero (San Pedro). Memoria y antecedentes. Septiembre de 1903. La Plata, 1903. Size 11 × 7, pp. 104. *Plans. Presented by M. Angel Etcheverry.*

Bolivia. ———

Anexos a la Memoria del Ministro de Relaciones Exteriores y Culto presentada al Congreso ordinario de 1903. La Paz, 1903. Size 11½ × 7½, pp. 364. *Map.*

The map shows the western borderlands of Bolivia, between 18° and 22° S.

Bolivia. ———

Sinopsis Estadistica y Geográfica de la República de Bolivia. Tomo ii. La Paz, 1903. Size 9 × 5½, pp. 330.

Bolivia—Railway. **Sheppard.**

Project for Railway Construction presented to the Minister of Public Works by the Director-General of Public Works, T. Clive Sheppard. [In Spanish and English.] La Paz, 1903. Size 11 × 7, pp. 86. *With Plan and Map.*

Brazil—Ceará. *Rev. Trimen. I. Ceará* **17** (1903): 325–405. **Beck.**

Diario de Mathias Beck. Trad. do Hollandez. *Map.*

Narrative of a voyage to Ceara in 1649, in the service of the Dutch West India Company.

Brazil—Ceará. *Rev. Trimensal I. Ceará* **17** (1903): 229–241. **Cardoso.**

Tricentenario da vinda dos primeiros Portuguezes ao Ceará. Descripção das festas em Fortaleza. Por Graccho Cardoso.

Chile. *B. American G.S.* **36** (1904): 1–21. **Smith**

The Economic Geography of Chile. By J. Russell Smith. *With Map.*

Costa Rica—Tírub. **Pittier de Fábrega.**

Die Tírub, Térribes oder Térrabas, ein im Aussterben begriffener Stamm in Costa Rica. Von H. Pittier de Fábrega. (Aus der Zeitschrift für Ethnologie, Heft 5, 1903, pp. 702–708.) Size 10 × 6½.

Dutch Guiana. *Tijds. K. Nederl. Aard. Genoots.* 21 (1904): 88–122. ——

Verslag van de Saramacca-Expeditie. *Map.*

The Saramacca, lately explored by a Government expedition, enters the sea some 50 miles to the west of the Surinam.

Panama Canal. *B. American G.S.* **35** (1903): 481–491. **Johnson.**

The Panama Canal in its Commercial Aspects. By E. R. Johnson.

Panama Canal. **Wegener.**

Der Panama Canal. (From Velhagen and Klasings Monatshefte, xviii. (1903–1904): 258–272. *Maps and Illustrations. Presented by the Author.*

Paraguay and Bolivia. **Audibert.**

Question de Limites entre El Paraguay y Bolivia. Articulos publicados en "La Democracia" y en "El Pueblo." Von El Dr. Alejandro Audibert. Asunción, 1901. Size 9 × 6½, pp. 144. *Map. Presented by the Consul-General for Paraguay.*

Paraguay and Bolivia. **Rolón.**

El Paraguay y Bolivia. Questión de Límites. Por Dr. Francisco Rolón. Ascunción, 1903. Size 10 × 6, pp 38. *Map.*

Peru. *B. Ministerio Fomento*, **1** (1903): 93–97. **Guevara.**

Carretera de Sicuani al Cuzco. A. Guevara. *With Map and Illustrations.*

Peru—Communications. *B. Ministerio Fomento*, **1** (1903): 17–23. **Hassel.**

Varaderos: Tamaya-Yuruá, Mishahua-Cuja, Fiscarrald y Sepahua-Cuja. J. M. von Hassel. *With Maps.*

On the results of an examination of the possibilities of communication with the Amazon basin.

Peru—Communications. ——

El Perú. La Comunicacion interoceanica a traves de los Andes Peruanos. El Amazonas y sus grandes afluentes navegables. Lima, 1903. Size 8 × 6, pp. 46. *Maps and Illustrations.*

Peru—Handbook. **Laos.**

A Handbook of Peru for Investors and Immigrants, with a description of the Central Route (Region of the Pichis). By Ricardo Laos. Baltimore, U.S.A., 1903. Size 7½ × 5½, pp. 53. *Maps and Illustrations.*

Peru—Mining. ——

Mines and Mining in Peru. Official Publication. Lima, 1903. Size 8½ × 5½, pp. 39. *Map and Illustrations.*

Peru—Moquegua and Tacna. **Paz-Soldán.**

Boletin del Cuerpo de Ingenieros de Minas del Perú. No. 3. Informe sobre la Provincia Litoral de Moquegua y el Departmento de Tacna. Por Francisco Alayza y Paz-Soldán. Lima, 1903. Size 9 × 6, pp. 123.

Peru—Rubber. ——

La Industria de las Gomas en el Peru. Lima, 1903. Size 8½ × 5½, pp. 42.

Peru—Surveys. ——

Vías del Pacífico al Marañón. Publicación de la Junta de Vías Fluviales. Ditto, al Madre de Dios. Lima, 1903. Size 12½ × 8½, pp. 34 and 187. *Plans and Illustrations.*

See article in *Journal* for December, 1903 (p. 672).

Peru—Surveys. ——

El Istmo de Fiscarrald. Publicación de le Junta de Vias Fluviales. Lima, 1903. Size 12½ × 8½, pp. xviii. and 184. *Maps and Profiles (separate), Illustrations. Presented by the Peruvian Government.*

Results of detailed surveys on the continental watershed, and the streams descending from it to the Amazon. (Cf. p. 602, *ante*)

Peru and Bolivia. *Petermanns M.* **49** (1903): 280–282. **Hann.**

Zum Klima des Hochlandes von Peru und Bolivia. Von Prof. Dr. J. Hann.

Salvador. **González.**

Datos sobre la República de El Salvador y Catalogo de los productos enviados por esta República á la Exposición Panamericana de Buffalo, N.Y. EE. UU. de A, 1901. Por el Doctor D. González. San Salvador. Size 8½ × 6, pp. 74.

Venezuela. **André.**

A Naturalist in the Guianas. By E. André. With a Preface by Dr. J. Scott Keltie. London: Smith, Elder, & Co., 1904. Size 9 × 6, pp. xiv. and 310. *Map and Illustrations. Price* 14*s. net. Presented by the Publishers.* [To be reviewed.]

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Stuart's journey. ——

P.R.G.S. Australasia: S. Australian Branch **6** (1902–3): 33–36.

Destruction of Stuart's Tree.

Cf. *Journal*, vol. xxi. p. 84.

Hawaii. *American J. Sci.* **16** (1903): 301–316. **Branner**

Notes on the geology of the Hawaiian Islands. By J. C. Branner. *Map and Illustrations.*

Marianne Islands—Guam. *B. American G.S.* **35** (1903): 475–477. ——

The Island of Guam. *With Map.*

Based on General Wheeler's report, and accompanied by a reduction of the War Department's map.

Marshall Islands—Nauru. *M.G. Ges. Hamburg* **19** (1903): 211–215. **Hernsheim**

Nauru, eine gehobene Koralleninsel der Marshallgruppe. Von Franz Hernsheim.

Melanesia. **Thilenius.**

Abh. K. Leopold.-Carolin. Deutsch. A. Naturforsch. **80** (1903): pp. 364.

Ethnographische Ergebnisse aus Melanesien. Von G. Thilenius. *With Map and Plates.*

New Hebrides—Espiritu Santo. *B.S.G. Lisboa* **21** (1903): 389–392. **Collingridge.**

Esploracion française à l'île de Santo. Por George Collingridge. *Map.*

On a recent French expedition to the island of Santo.

Tahiti—Discovery. *J. Polynesian S.* **12** (1903): 184–186. **Collingridge.**

Who discovered Tahiti? By George Collingridge.

Corrects the erroneous statement, sometimes made, that Tahiti was discovered by de Quiros.

Torres Straits. ——

Reports of the Cambridge Anthropological Expedition to Torres Straits. Volume v. —Sociology, Magic, and Religion of the Western Islanders. Cambridge: the University Press, 1904. Size 11½ × 9, pp. xii. and 378. *Maps and Illustrations. Price* 25*s. net. Presented by the Publishers.*

POLAR REGIONS.

Antarctic Exploration. **Arctowski.**

Une Page d'Histoire et d'Actualité! Par H. Arctowski. Attaché à l'Observatoire royal d'Uccle. Pp. 7. (Extrait du No. 121 (1903) du B.S. Belge d'Astronomie.)

Calls attention to an appeal by Maury for the scientific exploration of the Antarctic.

Antarctic—French Expedition. *La G., B.S.G. Paris* **9** (1904): 45–48. ——

Programme de l'expédition antarctique française. *With Map.*

See note in the February number (*ante*, p 262).

Antarctic—German Expedition. *Petermanns M.* **49** (1903): 273–277. **Supan.**
Die wissenschaftlichen Arbeiten der deutschen Südpolarexpedition vom 31. Januar 1902 bis 30. Mai 1903. Von Prof. Dr. A. Supan.

Antarctic—Swedish Expedition. *B. American G.S.* **36** (1904): 22–29. ——
The Swedish Antarctic Expedition, 1902–1903. *With Map.*

Arctic. *B. American G.S.* **35** (1903): 496–534. **Peary.**
Report of Commander R. E. Peary on Work in the Arctic, 1898–1902. *With Map and Illustrations.*

Greenland. *Smithsonian Misc. Collections* **45** (1903): 183–212. **Phalen.**
Notes on the Rocks of Nugsuaks Peninsula and its Environs, Greenland. By W. C. Phalen. *With Map and Plates.*

MATHEMATICAL GEOGRAPHY.

Surveying Instrument. *P. and T.R.S. Canada* **8** (1902): Sec. iii., 63–69. **Deville.**
On the Use of Wheatstone Stereoscope in Photographic Surveying. By E. Deville.

Surveying Instrument. **Ferguson.**
The Shanghai Society of Engineers and Architects, 1902–1903. The Pedograph. By T. Ferguson. Size 8½ × 5½, pp. 22. *With Illustrations.*

The working of this instrument depends on the pulsations of a poised hammer, which, in conjunction with manipulation by the operator whenever the direction of march is changed, give a record of the route traversed in chart form.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climatology. **Tyler.**
A Scheme for the Comparison of Climates. By W. F. Tyler. London, 1904. Size 10 × 6, pp. 31. *Diagrams.* (Reprinted from the *Journal of Balneology and Climatology* for February, 1904.) *Presented by the Author.*

Climatology—Forests. *Kungl. Svenska Vetens.-A. Årsbok* (1903): 75–87. **Hamberg.**
Skogarnes inflytande på Klimatet. Af H. E. Hamberg.

Erosion—Pothole. *Smithsonian Mis. Collections* **45** (1903): 100–103. **Merrill.**
On the Glacial Pothole in the National Museum. By G. P. Merrill. *With Plate.*

Geology. **Marr.**
Agricultural Geology. By J. E. Marr. London: Methuen & Co., 1903. Size 8 × 5½, pp. xii. and 318. *Map and Illustrations. Price* 6*s.*

Geology. *T.S. African Philos. S.* **14** (1903): 385–402. **Schwarz.**
An Unrecognized Agent in the Deformation of Rocks. By Ernest H. L. Schwarz. *With Plates.*

Glaciers. *La G., B.S.G. Paris* **8** (1903): 357–376. **Brunhes and Gobet.**
L'excursion glaciaire du IX^e^. congrès géologique international, synthèse des recherches et des idées de M. Penck. Par J. Brunhes et L. Gobet. *With Maps and Illustrations.*

Glaciers. **Hess.**
Die Gletscher. Von Dr. Hans Hess. Braunschweig: F. Vieweg und Sohn, 1904. Size 9½ × 6½, pp. xii. and 426. *Maps and Illustrations. Presented by the Publishers.*

Hydrology. *C. Rd. A. Sci.* **138** (1904): 117–123. **Boussinesq.**
Application de la théorie générale de l'Écoulement des nappes aqueuses infiltrées dans le sol aux fortes sources des terrains perméables, et, en particulier, à plusieurs de celles qui alimentent Paris. Note de M. J. Boussinesq.

Ice. *Deutsche Rundschau G.* **25** (1903): 272–274. **Koch.**
Die Eisbedeckung der fliessenden Gewässer in Winter. Von L. Koch.

Ice—Nieve penitente. *Z. Deut. u. Oesterr. Alpenv.* **34** (1903): 114–131. **Hauthal.**
Büsserschnee (Nieve penitente). Von Prof. Rudolf Hauthal. *Illustrations.*

Cf. note in *Journal*, vol. xx. p. 347. The present paper contains some excellent photographs of the phenomenon.

Inland Drainage. *Deutsche Rundschau* **26** (1903): 1–5, 117–125. **Henz.**
Die Abflusslosen Gebiete der Erde. Von W. Henz. *Map.*

Meteorites. *Popular Sci. Monthly* **64** (1904): 351–354. **Farrington.**
The Geographical Distribution of Meteorites. By Dr. O. C. Farrington. *With Map.*

Meteorology. *Monthly Weather Rev.* **31** (1903): 459–466, 509–516. **Bigelow.**
Studies on the circulation of the atmospheres of the Sun and the Earth. By T. H. Bigelow. *With Diagrams.*

Meteorology. *Ciel et Terre* **24** (1904): 579–583. **Teisserenc de Bort.**
Décroissance de la température avec la hauteur dans la région de Paris. Par L. Teisserenc de Bort.
See note in Monthly Record for May.

Meteorology—Historical. *Abk. K.P. Meteorolog. I.* **2** (1904): pp. 94. **Hennig.**
Katalog bemerkenswerter Witterungsereignisse von den ältesten Zeiten bis zum Jahre 1800. Von Dr. R. Hennig.
An interesting list of special meteorological events, with dates, from *circ.* B.C. 1754, as recorded in literature. The earlier entries relate to such events as great storms, overflowings of the Nile, etc., etc.

Meteorology—Winds. *Meteorol. Z.* **20** (1903): 501–512. **Hann.**
Ueber eine doppelte tägliche Periode der Windkomponenten auf den Berggipfeln. Von J. Hann.

Meteorology—Winds. *Monthly Weather Rev.* **31** (1903): 528–529. **Tower.**
Mountain and valley breezes. By W. S. Tower.

Oceanography—Currents. **Russell.**
Current Papers, No. 7. By H. C. Russell. (Reprinted from *Journal and Proceedings of the Royal Society of New South Wales*, vol. xxxvi.) Size 9 × 6, pp. 10. *Charts.*

Oceanography—"Dead Water." *Ann. Hydrographie* **32** (1904): 20–28. **Meyer.**
Totwasser. Von Kapt. H. Meyer.

Oceanography—Fauna. *Naturwissens. Wochenschrift* **19** (1903): 161–172. **Apitzsch.**
Die Anpassung der Tiefseefauna an die Eigenheiten des Tiefseewassers. Von Paul Apitzsch. *Illustrations.*

Phytogeography. *C. Rd.* **138** (1904): 592–593. **Dauphiné.**
Sur la lignification des organes souterraines chez quelques plantes des hautes régions. Par M. André Dauphiné.

Phytogeography. **Schimper.**
Plant-Geography upon a Physiological Basis. By Dr. A. F. W. Schimper. The Authorized English Translation by W. R. Fisher. Revised and Edited by P. Groom and I. B. Balfour. Parts ii., iii., and iv. Oxford: Clarendon Press; London: H. Frowde. 1903–1904. Size 10 × 6½, pp. 257–840. *Maps and Illustrations. Price, each part, 9s. net. Presented by the Publishers.* [To be reviewed.]

Phytogeography. **Willis.**
A Manual and Dictionary of the Flowering Plants and Ferns. By J. C. Willis. Second Edition. Cambridge: The University Press, 1904. Size 7½ × 5, pp. xii. and 670. *Price* 10*s.* 6*d. Presented by the Publishers.*

Seismology. *Sitzb. K.B.A.W. München* (1903): 631–671. **Günther and Reindl.**
Seismologische Untersuchungen. Von S. Günther und J. Reindl. *With Map.*

Speleology. *Spelunca* **5**, No. 32 (1903): pp. 32. **Martel.**
Les Cavernes de Majorque. Par E. A. Martel. *Plan and Illustrations.*

Terrestrial Magnetism. **Pochettino.**
Atti R.A. Lincei, Rendiconti **13** (1 Sem.) (1904): 96–101.
Sulla variazione del campo magnetico orizzontale terrestre coll' altezza sul livello del mare. Nota del dott. A. Pochettino.

Volcanoes. **Lobley.**
Volcanic Action and the West Indian Eruptions of 1902. By J. Logan Lobley. (Paper read before the Victoria Institute.) Size 8½ × 5½, pp. 20. *Presented by the Author.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Driesmans.**

Rasse und Milieu. Von H. Driesmans. Berlin: J. Räde, 1902. Size 8 × 5½, pp. x. and 236. *Price 2s. 4d.*

Civilization. **Cunningham.**

An Essay on Western Civilization in its Economic Aspects. By W. Cunningham, D.D. Two vols. Cambridge: The University Press, 1900–1902. Size 8 × 5½, pp. (vol. i.) xii. and 220; (vol. ii.) xii. and 300. *Maps. Price, each vol., 4s. 6d.*

Commercial Geography. *Ymer* **23** (1903): 243–268. **Ahlenius.**

Kaffe, te och rörsocker, deras ursprungliga hem och viktigaste produktionsområden. Af Karl Ahlenius. *With Maps.*

On the original habitat and present centres of production of coffee, tea, and sugar.

Historical—Colonization. *Beiträge Kolonialpolitik* **5** (1903–1904). **Jacobi.**

Ein bayrisches Kolonialunternehmen im 17 Jahrhundert. Von Dr. E. Jacobi.

Historical—Geography of Odyssey. **Bérard.**

Victor Bérard. Les Phéniciens et l'Odyssée. 2 vols. Paris: A. Colin, 1902–1903. Size 11 × 8, pp. (vol. i.) viii. and 592; (vol. ii.) viii. and 630. *Maps and Illustrations.*

The author endeavours to identify the localities named in the Odyssey by the light of modern research.

History of Cartography. *B.S.G. Lisboa* **21** (1903): 357–376. **Da Fonseca.**

O Atlas do Visconde de Santarem. Por Martinho A. da Fonseca.

BIOGRAPHY.

Baker. *National G. Mag.* **15** (1904): 40–43. **Dall.**

Marcus Baker. By Dr. W. H. Dall. *With Portrait.*

Mr. Baker, well known for his work on the U.S. Geodetic and Geological Surveys, died suddenly in December last.

Barker. *P.R.S. Australasia: S. Australian Branch* **6** (1902–1903): 19–30. ——

Memorial to Capt. Collet Barker at Mount Barker. *Illustration.*

Cf. *Journal*, vol. xxi. p. 458.

Hügel. ——

Charles von Hügel. Cambridge: 1903. Size 10½ × 7½, pp. 76. *Presented by Baron Anatole von Hügel.*

A collection of sketches of the life of the Austrian traveller and botanist, who received the Patron's Medal of our Society in 1849 for his explorations in Kashmir.

GENERAL.

Bibliography. ——

International Catalogue of Scientific Literature. Second Annual Issue. Geography, Mathematical and Physical. London, 1904. Size 8½ × 5½, pp. 347.

This follows in the main the system adopted in the first issue (*Journal*, vol. xxii. p. 560), though there are a few minor improvements. The bulk of the catalogue is considerably greater than in the previous volume, though the entries cannot by any means be considered as exhaustive. Perhaps the most important omission is that of a section dealing with the geographical conditions of vegetation.

Geographical Bibliography. **Dinse.**

Zur Systematik der Erdkundlichen Literatur. Anordnungsplan der Bibliothek der Gesellschaft für Erdkunde zu Berlin. Von Dr. Paul Dinse. Berlin, 1904. Size 10 × 7, pp. 20.

Introduction to the new Library Catalogue of the Berlin Geographical Society, on the system of classification adopted.

Geography. **Krümmel.**

Ausgewählte Stücke aus den Klassikern der Geographie für den Gebrauch an Hochschulen zusammengestellt von O. Krümmel. Zweite Reihe: aus A. v. Humboldt, Carl Ritter, Oscar Peschel, Charles Darwin, und Ferdinand von Richt-

hofen. Kiel und Leipzig: Lipsius & Tischer, 1904. Size 9½ × 6½, pp viii. and 174. *Presented by the Editor.*

Cf. *Journal* for January (*ante*, p. 120).

Geography and History. **Oberhummer.**

Die Stellung der Geographie zu den historischen Wissenschaften. Antrittsvorlesung gehalten bei Uebernahme der historisch-geographischen Lehrkanzel an der Universität Wien von E. Oberhummer. Wien: Gerold & Co., 1904. Size 10½ × 7, pp. 32. *Price* 1*s.*

Miscellaneous Essays. **Cust.**

Linguistic and Oriental Essays. Written from the year 1840 to 1903. Seventh Series. By R. N. Cust, LL.D. London: Luzac & Co., 1904. Size 8½ × 6, pp. 418 and 238. *Portrait and Diagram. Presented by the Author.*

The most important essay is one on common features in religious belief.

Missions. **Smith.**

Short History of Christian Missions from Abraham and Paul to Carey, Livingstone, and Duff. By Dr. George Smith. Sixth Edition. Edinburgh: T. & T. Clark, [1904]. Size 7½ × 5, pp. xiv. and 252. *Portraits. Price* 2*s.* 6*d. Presented by the Publishers.*

Mountaineering. **Le Blond.**

Adventures on the Roof of the World. By Mrs. Aubrey le Blond (Mrs. Main). London: T. Fisher Unwin, 1904. Size 9 × 6, pp. xvi. and 334. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

A further collection of thrilling tales of mountain adventure, taken mostly from published narratives.

Portuguese Colonies. ———

L'Epopée Portugaise. Histoire Coloniale. Por Almada Negreiros. Paris, 1902. Size 8 × 5, pp. 77. *Maps.*

Tables. **Martin.**

Up-to-date Tables of Imperial, Metric, Indian, and Colonial Weights and Measures. By Alfred J. Martin. London, 1904. Size 5½ × 4½, pp. 255. *Presented by the Publishers.*

Travel. **Grothe.**

Auf türkischer Erde. Reisebilder und Studien von Hugo Grothe. Zweite Aufl. Berlin: Allgemeiner Verein für Deutsche Litteratur, 1903. Size 9 × 6, pp. 456. *Illustrations. Price* 6*s.* 9*d.*

Deals in turn with journeys in Armenia, Tripoli, Asia Minor, Macedonia, etc. In Tripoli the writer penetrated some little distance into the interior.

Travels. **Cust.**

Tours and Travels. By Dr. R. N. Cust. (Extracted from 'Linguistic and Oriental Essays,' Series vii.) Hertford: Printed by Stephen Austin & Sons, 1903. Size 8½ × 6, pp. 12. *Presented by the Author.*

A recapitulation of all the journeys undertaken by the writer.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from April 1 to 30, 1904.

2 miles to 1 inch—

District map, with hills and printed in colours, Oxford, on thin paper or mounted on linen: thin paper, flat or folded in cover, 1*s.* 6*d.*; mounted on linen, 2*s.*

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(Third edition) with hills in brown or black, 316, 330, 331, 344, 345, 1*s. each* (engraved).

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6-inch—County Maps (first revision):—

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(*E. Stanford, London Agent.*)

Germany. **Ebbecke.**

Ebbecke's Verkehrskarten. Scale 1:800,000 or 12·6 stat. miles to an inch. Sheet 7, Nordöstliches Deutschland. Dritte Auflage. Lissa: Friedrich Ebbecke. *Price* 30*pf.*

Ireland. **Bartholomew.**

Bartholomew's New Reduced Ordnance Survey of Ireland. Scale 1:253, 440 or 4 stat. miles to an inch. Sheets: 4, Limerick and Shannon; 7, Wexford and Waterford. Edinburgh: John Bartholomew & Co. *Price* 2*s. net, mounted on cloth. Presented by the Publisher.*

Bartholomew's excellent series of Reduced Ordnance Maps of England and Scotland are so well known and generally appreciated by tourists and others that the issue of a similar series for Ireland, which has now been commenced, is certain to meet with a ready welcome. This, however, is to be on only half the scale of the others, *i.e.* 4 miles to an inch instead of 2 miles as before. For some districts of Ireland this would doubtless be large enough for all practical purposes, but there are others where the scale of 2 miles to an inch would not be any too large. In general style of production these sheets are similar to those previously published, relief being represented by contours and colour tinting, and roads, distinguished according to their importance, in brown.

ASIA.

Asia. **Russian Government.**

Map of the Southern Frontier Regions of Asiatic Russia. Scale 1: 1,168,031 or 18·4 stat. miles to an inch. Sheets: IX^{bis}, Kurile Islands; X^{bis}, Hakodate; XI^{bis}, Tokio; XII^{bis}, Nagasaki; XXX. Lungan-fu, Chengtu-fu; XXXI. Chungking-fu, Chang-sha-fu. St. Petersburg: Military Topographical Department. [In Russian.]

Sheets IX^{bis}, X^{bis}, XI^{bis}, and XII^{bis}, were not included in the original scheme of this map, but must be considered as supplementary. They are, however, important

at the present time, inasmuch as they include the whole of Japan. Sheets XXX. and XXXI. represent the upper Yang-tse region in the neighbourhood of Cheng-tu. This map includes a far greater portion of the continent of Asia than its title would lead to suppose, and extends from a considerable distance to the north of the Amur, to the coast of Baluchistan and Northern India, and from the Black sea to the Pacific coast.

Ceylon. **Surveyor-General of Ceylon.**

Ceylon. Scale 1 : 506,880 or 8 stat. miles to an inch. From surveys initiated by and carried out during the administration of His Excellency the Right Hon. Sir J. West-Ridgeway, G.C.M.G., K.C.B., K.C.S.I., 1896–1903. Mr. F. H. Grinlinton, C.M.G., F.R.G.S., Surveyor-General. Colombo: Surveyor-General's Office. *Presented by the Surveyor-General of Ceylon.*

This is an advance proof of a useful general map of Ceylon, compiled from recent surveys. Hill-shading is in brown, and water blue; boundaries of provinces are shown in various colours. Considerable progress has now been made with the 1-inch survey sheets of the island, and a number of advance sheets have been printed, but until these are generally available the above map ought to be of considerable service.

Eastern Asia. **Military Geographical Institute, Vienna.**

Südliche Mandschurei mit Nord-Korea. Scale 1 : 1,500,000 or 23·6 stat. miles to an inch. Auf Grundlage des offiziellen russischen Kartenmateriales ausgeführt im K. u. K. Militärgeographischen Institute zu Wien, 1904.

One of the many maps recently published to illustrate the seat of war in the Far East. It is based upon the Russian Staff maps, and printed in colours, all roads, railways, etc., being clearly distinguished.

Eastern Asia. **Sprigade and Rux.**

Russisch-Japanischer Kriegsschauplatz. Karte II. Süd-Mandschurei, Korea, Nordost-China. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. Bearbeitet von P. Sprigade, gezeichnet von W. Rux. Berlin: Dietrich Reimer (Ernst Vohsen), 1904. *Price* 1 *mark.*

Korea. **Mockler.**

Map of Korea. Scale 1 : 1,355,000 or 21·4 stat. miles to an inch. Transliterated from a Russian map, dated 1900, in the Intelligence Branch Q.M.G.'s Department of India. By Major G. H. G. Mockler, 30th Burma Infantry. Simla, 1903.

Tongking. **Service Géographique de l'Indo-Chine.**

Carte du Reseau Electrique Militaire du Tonkin, (Juin, 1903). Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Service Géographique de l'Indo-Chine.

An outline map of Tongking, showing by different symbols and colours, telegraphs, lines, and stations, supplemented by tables giving detailed particulars concerning the lines.

Tongking. **Service Géographique de l'Indo-Chine.**

Carte du Delta du Tonkin. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Sheets: 4, Hiêp-Hoa; 5, Phu-Lang-Thu'o'ng; 7, Phu-Vinh; 8, Thach Loi; 9, Phu Lo; 10, Bac Ninh; 12, Sontay; 13, Hoai Duc Phu; 14, Phu Tu Son; 15, Gia Binh; 16, Sept Pagodes; 19, Cau Do; 20, Hanoi; 21, Bau Yen Nhan; 22, Hai Duong; 26, Phu Thanh Oai; 27, Thuong Tin Phu; 28, Ke Sat; 33, Phu Ung Hoa; 34, Phu Xuyen; 35, An Thi; 40, Guang Thua; 41, Dong Van; 42, Hung Yen; 48, Phu Ly; 49, Nhu Trac; 54, Y Yen; 55, Nam Dinh; 59, Ninh Binh; 60, Phu Nghia Hung. Service Géographique de l'Indo-Chine, 1902–1903. *Price* $1 *each sheet.*

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sudan, Sheet (Provisional) 66-J, Lower Sobat. British Central Africa, Sheets (Provisional): 111-H, Fort Maguire; 111-K, Dedza Boma; 111-L, Mlangeni; 111-O, Kirk Mountains; 111-P, Blantyre; 117-D, Chiromo. London: Intelligence Division, War Office. Stanford. 1902–1903. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

The Lower Sobat sheet replaces the Fashoda sheet of the earlier edition; the six British Central Africa sheets have been revised, and small additions made to boundaries and detail.

Egypt. **Egyptian Survey Department.**

Topographical Map of Gharbia Province. Scale 1 : 10,000 or 0·15 stat. mile to an inch. Sheets—N.E.: 35–1, 35–3, 36–1, 37–1, 37–3, 38–1, 38–2, 38–3, 39–2, 39–3, 39–4, 40–2, 40–3, 40–4. N.W.: 37–1, 38–1, 38–3, 38–5, 39–2, 39–4, 40–1.—Map of Northern Gharbia. Scale 1 : 200,000 or 3·1 stat. miles to an inch.—Provisional map of Aswan Province. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Cairo: Survey Department, 1904. *Presented by the Director-General, Survey Department, Cairo.*

French West Africa. **Meunier and Barralier.**

Carte de l'Afrique Occidentale Française. Dressée par A. Meunier et E. Barralier d'après les documents les plus recents. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. 6 Sheets. Ministère des Colonies. Service Géographique et des Missions. M. Barbotin, Chef du Service, Paris, 1903.

This map extends from the delta of the Niger to the twentieth degree of north latitude, and from the west coast to the eastern shore of Lake Chad. Routes are shown in red, and those that are merely laid down from report are distinguished from those that have been actually followed by explorers. Telegraph and steamship lines around the coast have been laid down, and altogether a great deal of information is given upon the map.

German South-West Africa. **Hartmann.**

Dr. Georg Hartmann's Karte des nördlichen Teiles von Deutsch—Südwest—Afrika. Scale 1 : 300,000 or 4·7 stat. miles to an inch. 6 Sheets. Hamburg: L. Friederichsen & Co., 1904. *Price* 30 *marks.*

This map of the north part of German South-West Africa includes the area between 17° and 21° S. lat., and between the coast and 19° E. long. It is based upon recent survey work of German officers, including latitude and time observations, azimuths, trocheameter measurements, and route surveys and sketches. A list of the authorities consulted and material employed is given with the map. The character of the country is clearly indicated by tints of colour, the desert tracts being readily distinguishable from those where more or less vegetation exists. Wells are shown, and the map is as complete as it is possible to make it from the information available.

Tunis. **Service Géographique de l'Armée, Paris.**

Tunisie. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Sheet XI., Hedil. *Price* 1.50*fr.* Scale 1 : 100,000 or 1·56 stat. mile to an inch. Sheets: XLI., Bou Rhanem; XLVI., Bou Chebka; LIII., Fériana. *Price* 1.20*fr. each sheet.* Paris: Service Géographique de l'Armée.

AMERICA.

Buenos Aires. **Hauthal.**

Geologische Karte der Provinz Buenos Aires. Von R. Hauthal. Scale 1 : 3,500,000 or 55·4 stat. miles to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang, 1904, Tafel 6. Gotha: Justus Perthes. *Presented by the Publisher.*

Canada. **Surveyor-General's Office, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Fort Alexander Sheet (3), East of Principal Meridian, revised to March 8, 1904; Manitoba House Sheet (11), West of Principal Meridian, revised to March 8, 1904; Sounding Creek Sheet (68), West of Fourth Meridian, revised to August 22, 1903. Ottawa: Surveyor-General's Office, 1904. *Presented by the Surveyor-General of Canada.*

GENERAL.

World. **Petrie and Schokalsky.**

Marck's large General Table Atlas. Edited by Prof. E. J. Petrie and Colonel J. de Schokalsky. Parts 3 and 4. St. Petersburg: A. F. Marcks, 1904. [In Russian.] *Presented by the Publisher.*

These are parts of a new Russian atlas now in course of publication, and which to a great extent is based upon the well-known and excellent Wagner and Debes atlas, published at Leipzig some four years ago. The first two issues were noticed in the *Geographical Journal* for February last. The present parts contain ten sheets of maps: No. 11, Europe, showing railways and steamship routes; Nos 17, 18, 21, and 22, four sheets of a general map of European Russia on the scale of 1 : 2,000,000; No. 48, South-West Asia, on the scale of 1 : 10,000,000; No. 50, Southern Asia, including India, Tibet and Siam, and Indo-China, on the scale of 1 : 10,000,000;

No. 51, Eastern Archipelago; No. 53, Africa, on the scale of 1:23,000,000; and No. 54, Equatorial Africa, on the scale of 1:10,000,000.

World. **Stanford.**

Stanford's London Atlas of Universal Geography, exhibiting the Physical and Political divisions of the various countries of the world. One hundred and ten maps, with a list of latitudes and longitudes. Third edition, revised and enlarged. London: Edward Stanford, [1904.] *Price* £12. *Presented by the Publisher.*

A special notice of this atlas appeared in the May number of the *Geographical Journal*.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich, 29 and 30 Lieferung. Gotha: Justus Perthes. *Price* 60 *pf. each part.*

These two parts are in one cover, and contain the following maps: Nos. 48 and 49, sheets 5 and 6 of a six-sheet map of Russia on the scale of 1:3,700,000; No. 76, Australia and Polynesia, scale 1:30,000,000; No. 82, North America, scale 1:25,000,000. The map of North America is a revised edition; the others are entirely new.

CHARTS.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Charts of the North Atlantic and Mediterranean for April and May, 1904. London: Meteorological Office. *Price* 6*d. each. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for March and April, and of the North Pacific Ocean for April and May, 1904. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Chile-Argentine Frontier Region. **Calvert.**

Twelve Photographs taken on the Chile-Argentine frontier, by W. Bartlett Calvert, Esq., in 1902. *Presented by H. J. Elwes, Esq., F.R.S.*

An excellent set of enlargements of views of the Southern Andes, measuring 12 × 10 inches. They are specially interesting as illustrating the natural features of the country.

(1 and 2) Perforated rock of andesite on the banks of the Traful river; (3) Large tree of *Araucaria imbricata* at about 5000 feet on the pass between Lolco and Lonquimay, Chile; (4) Beech forest near sources of the Renaico river; (5) Araucaria forest in the Sierra de Pemehue, at about 4000 feet; (6) Isolated araucarias in the Lolco valley, Tolhuaca and Lonquimay volcanoes in background; (7) Beech forest in the upper Renaico valley; (8) Chilean cypress on banks of Rio Limay, near junction of Traful river; (9) Camp on bank of Rio Limay; (10) Loguna Fria, on the road from Lake Nahuel Huapi to Perez Rosales pass; (12) Mount Tronador, from Casa Pangue valley.

General. **Isaacson.**

One hundred and thirty-five photographs taken by F. J. Wootton Isaacson, Esq., on a trip round the world in 1903. *Presented by F. J. Wootton Isaacson, Esq.*

Mr. Isaacson, who has previously presented to the Society many photographs taken by him in various parts of the world, has now added the following interesting series to our collection:—

Norfolk island—(1) Landing pier; (2 and 3) Views of Philip island; (4) Part of jail, showing ruined cells; (5) Avenue of pines planted by convicts; (6) Interior of Melanesian Mission Church; (7) Exterior of Melanesian Mission Church; (8) View of coast near Cable Station; (9) View of coast near Cable Station, showing a Norfolk island pine; (10) Kingston. Aneityum island—(11) Anelgauhat harbour; (12) Bathing pool on the Inwei Lelikai river; (13) Inwei Lelikai river, looking up-stream; (14) Vila harbour, Vate island; (15) War-drums in Meli village, Meli island; (16) Lonwolwol and Dr. Bowie's hospital, Ambrym island. Gizo island—(17) Interior of canoe-house; (18) Canoe-house and landing-place; (19) Native meeting-house; (20) The anchorage, from Government House; (21) Canoes round s.s. *Titus*, (22) Distant

view of Gizo island; (23) Canoes off Gizo island. Simbo island—(24) Lagoon and hut sulphur springs; (25) King Billandana's canoe-house, Gepi village; (26) Southern entrance to lagoon; (27) View from the beach of Awa island. Rubiana island—(28) Making shell armlets; (29 and 30) Natives, hut and canoes; (31) Back entrance to Rubiana; (32) Scene in Back Passage; (33) Virgin bush, Back Passage. Lillihina island—(34 and 35) Marovo lagoon; (36) Natives, Marovo lagoon. Neal island—(37) Village scene; (38, 39, and 41) Big banyan tree; (40) Weighing ivory nuts. Guadalcanar island—(42) Scene on river Kombua; (43) Tree bridge over river Kombua; (44) Group on bank of river Kombua; (45) Rua Sura off Guadalcanar island. Santa Cruz island—(46) Graciosa bay; (47) Village scene; (48) Boys outside copra house; (49) Native wearing nose-ornament; (50) Half-breed baby; (51 and 53) Mouth of river near landing-place, Graciosa bay; (52) Group of women in village. Tanna island—(54) Port Resolution; (55) Port Resolution and Captain Cook's rock. Lord Howe island—(56) View from anchorage; (57 and 58) Distant views of Lord Howe island; (59) View of Aola island; (60) Distant view of Gavutu island; (61) View of Gavutu island showing store and pier; (62) Boats leaving Aola island; (63 and 64) Views of Tulagi island; (65) View from Gavutu island, Tulagi island in distance; (66 and 67) Canoes off Kulam Bangra island, Blackett Straits; (68) Canoe off Faisi island; (69) Mrs. Tindal's store, Faisi island; (70) Scene among the Shortland group near Awa island; (71 and 72) View of Stephen's island; (73) Lighthouse at entrance to Cook's strait; (74) View of Brother's island. Sandwich islands—(75 and 76) Views looking through the Pali Gap, Honolulu; (77) Nuuanu Pali, Honolulu; (78) Devil's Punch Bowl, Honolulu; (79) Honolulu and Devil's Punch Bowl, from s.s. *Moana*. New Zealand—(80) Ohinemutu and Lake Rotorua; (81) Ohinemutu from hill; (82) Queen Victoria's Diamond Jubilee statue, erected by Maoris, Ohinemutu; (83) Carved posts of submerged native hut, Ohinemutu; (84) Maoris church, Ohinemutu; (85) Whakarewarewa geyser playing; (86 and 87) Whakarewarewa geyser; (88) Landing-place, Wairoa, Lake Tarawera; (89 and 90) Mount Tarawera; (91 and 92) Lake Rotomahana; Boiling springs, Lake Rotomahana; (94 and 97) Waimangu geyser; (98) Tikitere, Lake Rotorua; (99) The Inferno, Tikitere; (100) General view of Tikitere; (101) Mount Washington, Kandava island. Canada—(102) View near Cedar Creek; (103 and 104) Gate of Beaver river; (105) View near Beavermouth; (106) Gorge of Colombia river; (107 and 108) Kicking Horse river; (109) View of Palliser; (110) Path near Banff Springs hotel; (111) Scene from path near Banff Springs hotel; (112 and 113) Scenes near Banff; (114) Bow river, Banff; (115) View of Bow river from Banff Springs hotel; (116) Cow moose, National Park, Banff; (117) Cow moose and calf, National Park; (118) Buffalo cows and calves, National Park; (119) Buffalo bull, National Park; (120) Wapiti or elk, National Park; (121 and 122) Montmorency falls; (123 and 124) Montmorency river; (125–127) Natural steps, Montmorency river; (128) Kent House, formerly the residence of the Duke of Kent; (129) View of Beaufort; (130) Little Champlain Street, Quebec; (131) Sous-le-Cap Street, Quebec; (132) View from Levis looking towards Quebec. Egypt—(133 and 134) View of the Suez canal; (135) View of Port Suez.

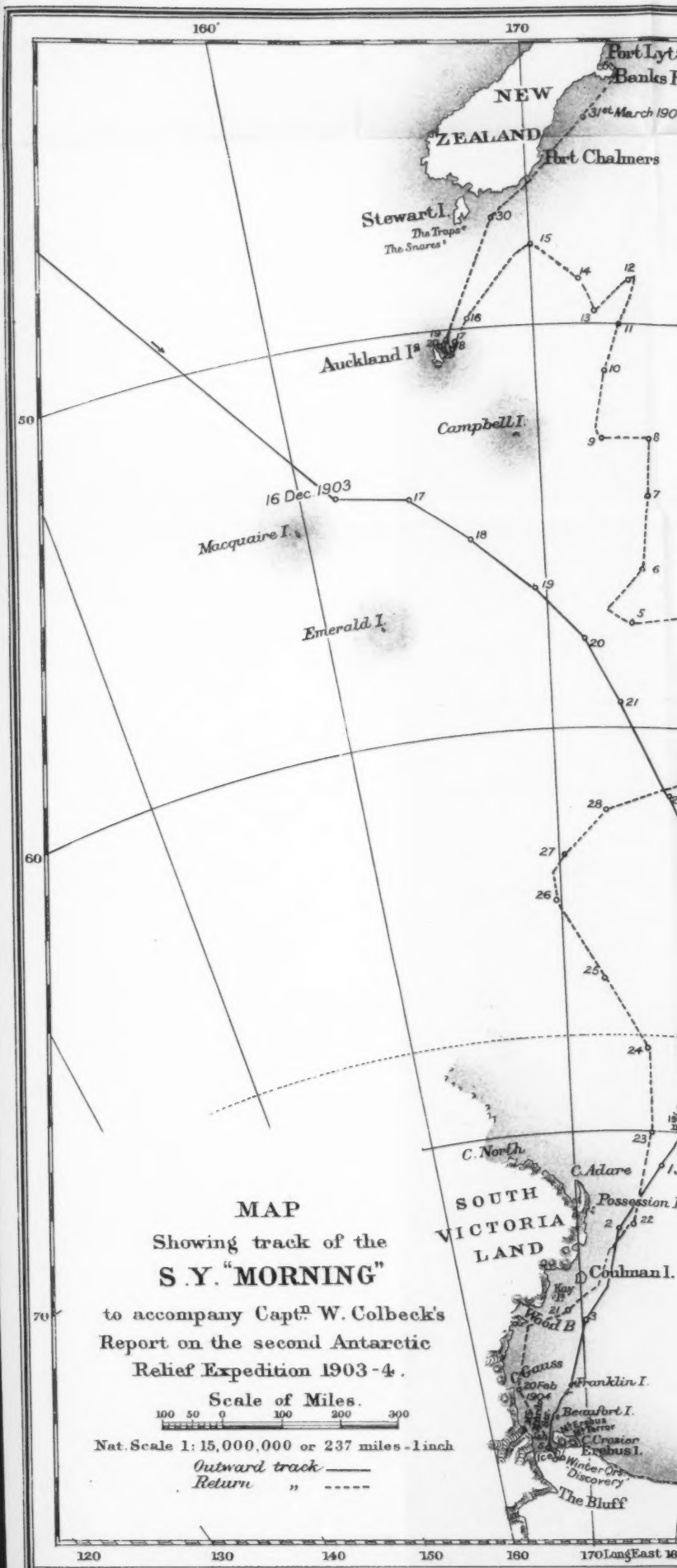
Korea.

Twenty-three Photographs of Korea. *Presented by the late H. E. Charlesworth, Esq.*

These photographs are specially interesting at the present time. They are principally of the inhabitants, and many of them are taken in the neighbourhood of the capital.

(1 and 2) Street scene, Seoul; (3) Stone pillar, Seoul; (4) Bell pagoda, Seoul; (5) General store, Seoul; (6) Poultry dealers; (7) Lady's sedan chair; (8) Boatbuilders; (9) Chess-players; (10) Making thatch ridge of house; (11) Bleaching linen; (12) Ye-Chai Sun, cousin of the Emperor; (13) A military official; (14) Shoeing a pony; (15) Ox-cart laden with stones; (16) Market scene; (17) Sawing wood; (18) The Emperor of Korea; (19) Woman washing clothes; (20) Native spade; (21) Cooper at work; (22) Lantern and royal tomb; (23) Upper-class Koreans.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.



MAP

Showing track of the

S.Y. "MORNING"

to accompany Capt.n W. Colbeck's Report on the second Antarctic Relief Expedition 1903-4.

Scale of Miles.

100 50 0 100 200 300

Nat. Scale 1: 15,000,000 or 237 miles - 1 inch

Outward track ——

Return " - - - - -

Projection, Secant Conical.

Published by the Royal Geogr

S.Y. "MORNING" TRACK CHART.
COLBECK.

Geographical Society.

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